C. J. INNOCENT.

ARCHITECT

SHEFFIELD.

1865	SUN.	Mon.	Tues.	Wed.	Thur.	Frid.	Sat.
Jan.	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	...	...	...	...
Feb.	...	...	...	1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	...	...	...	...
Mar.	...	...	...	1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30	31	...
April	...	...	...	...	...	...	1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	...	...	...	...	...	...
May	...	1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31	...	...	...
June	...	...	...	...	1	2	3
	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	...

1865	SUN.	Mon.	Tues.	Wed.	Thur.	Frid.	Sat.
July	...	...	...	...	...	...	1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31	...	...	...	...	...
Aug	...	...	1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	...	...
Sep.	...	...	...	...	...	1	2
	3	4	5	6	7	8	[illegible]
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
Oct.	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	...	...	...	...
Nov.	...	...	...	1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30	...	...
Dec.	...	...	...	...	...	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
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Middlesex

A HAND-BOOK

OF

FORMULÆ, TABLES, AND MEMORANDA,

FOR

ARCHITECTURAL SURVEYORS,

AND OTHERS ENGAGED IN BUILDING.

A

HAND-BOOK

OF

FORMULÆ, TABLES, AND MEMORANDA

FOR

Architectural Surveyors,

AND OTHERS ENGAGED IN BUILDING.

BY

JOHN THOMAS HURST,

CIVIL ENGINEER.

LONDON:

E. AND F. N. SPON, 16, BUCKLERSBURY.

MDCCCLXV.

C. WHITING, BEAUFORT HOUSE, STRAND.

PREFACE.

The duties of the Architectural Surveyor have latterly become much more varied and extensive than they were in former years.

His duties were then chiefly confined to the measuring and valuing of ordinary builders' work, and to estimating the value of buildings as between buyer and seller and between landlord and tenant. But, at the present time, he is also called upon to estimate the quantities of materials and workmanship in numerous projects of the Civil Engineer, including iron construction of almost every variety; and it devolves upon him to make valuations of the works of the Engineer as well as of the erections of the Architect and Builder.

Able treatises have been published upon every subject connected with Architecture, Engineer-

ing, Building, and the Valuation of Property, but these, from their variety and bulk, are unsuitable for constant every-day reference; and none of the numerous publications containing tables and memoranda are sufficiently comprehensive to answer the requirements of a modern Surveyor's practice.

It has, therefore, occurred to the Author that a small work embracing all the more important subjects connected with the practice of the Architectural Surveyor, if concisely written and printed in a convenient form, would be a valuable addition to his library.

The scientific information contained in this little volume is, of course, not original, but has been culled from the works of others. For the principles and details of construction, the strength of materials, &c., the Author is particularly indebted to the labours of Barlow, Tredgold, Rankine, Fairbairn, Hodgkinson, Gordon, Latham, Shields, Neville, Eytelwein, Clegg; and for the Valuation of Property to the publications of Price, Smart, Milne, Farr, Biden, Yool, Bayldon, &c., and the source from whence

information was directly obtained is generally acknowledged in the body of the work. There is much, however, which is common property, or which could not be referred to any particular Author.

Although no claim is made for originality, yet several of the formulæ and tables are now presented to the public for the first time; and the articles on subjects more especially belonging to the Surveyor's profession have been expressly written for this work.

The Author feels it incumbent upon him to acknowledge his obligations to many of his friends who have placed valuable manuscripts at his disposal, or have given him assistance or advice. To Mr. Josiah Atwool, Mr. Josiah Hunt, Mr. Edward Bell, Mr. Arthur Ashpitel, Mr. S. C. Aubrey, in particular, and to other gentlemen, too numerous to mention, who have taken a kind interest in the progress of the work, the Author takes this opportunity of returning his sincere thanks.

LONDON, 15th NOVEMBER, 18 4.

HURST'S

HANDBOOK FOR SURVEYORS.

FORMULÆ USEFUL IN DESIGNING BUILDERS' WORK.

THE STRENGTH OF TIE BARS, SUSPENSION RODS, &c.

A = Area of section of rod in inches.
S = Breaking weight in tons.
Then $S = C \times A$.

Cohesive force per square inch......	$= C = 50$ tons.	for	steel.
	$= 20$	„	wrought iron.
	$= 7$	„	cast iron.
	$= 8$	„	copper, cast.
	$= 8$	„	brass, cast.
	$= 3\frac{1}{2}$	„	zinc.
	$= \frac{3}{4}$	„	lead.
	$= 7$	„	teak.
	$= 5$	„	oak, fir, beech, and elm.
	$= 4$	„	larch.
	$= 3$	„	cedar & poplar

$$\text{Factor of safety} = \frac{S}{4}$$

THE STRENGTH OF IRON CHAINS.

Short-Linked.			Studded.		
Diam. of Link.	Breaking Weight.	Proof Strength.	Diam. of Link.	Breaking Weight.	Navy Proof.
inches.	tons.	tons.	inches.	tons.	tons.
$\frac{5}{16}$	$2\frac{3}{4}$	$1\frac{1}{4}$	$\frac{5}{8}$	$12\frac{1}{2}$	7
$\frac{3}{8}$	4	$1\frac{3}{4}$	$\frac{11}{16}$	15	$8\frac{1}{2}$
$\frac{7}{16}$	$5\frac{1}{4}$	$2\frac{1}{2}$	$\frac{3}{4}$	18	$10\frac{1}{8}$
$\frac{1}{2}$	7	$3\frac{1}{4}$	$\frac{7}{8}$	$24\frac{1}{2}$	$13\frac{3}{4}$
$\frac{9}{16}$	9	$4\frac{1}{4}$	1	32	18
$\frac{5}{8}$	11	5	$1\frac{1}{8}$	$40\frac{1}{2}$	$22\frac{3}{4}$
$\frac{11}{16}$	$13\frac{1}{4}$	$6\frac{1}{4}$	$1\frac{1}{4}$	50	$28\frac{1}{2}$
$\frac{3}{4}$	16	$7\frac{1}{2}$	$1\frac{3}{8}$	$60\frac{1}{2}$	34
$\frac{13}{16}$	$18\frac{3}{4}$	$8\frac{3}{4}$	$1\frac{1}{2}$	72	$40\frac{1}{2}$
$\frac{7}{8}$	$21\frac{3}{4}$	10	$1\frac{5}{8}$	84	$47\frac{1}{2}$
$\frac{15}{16}$	25	$11\frac{1}{2}$	$1\frac{3}{4}$	98	$55\frac{1}{8}$
1	$28\frac{1}{2}$	$13\frac{1}{2}$	$1\frac{7}{8}$	113	$63\frac{1}{4}$
$1\frac{1}{16}$	32	15	2	128	72
$1\frac{1}{8}$	35	$16\frac{3}{4}$	$2\frac{1}{8}$	145	$81\frac{1}{4}$
$1\frac{1}{4}$	$44\frac{1}{2}$	$20\frac{1}{2}$	$2\frac{1}{4}$	162	$91\frac{1}{8}$

RULE TO FIND THE BREAKING WEIGHT OF CHAINS.

Divide the square of the diameter of one bar of the link, in sixteenths of an inch, by 9 for short-linked chains, and by 8 for studded chains.

The Strength of Ropes.

Hemp.		Iron Wire.		Steel Wire.	
Girth in inches.	Breaking Weight in tons.	Girth in inches.	Breaking Weight in tons.	Girth in inches.	Breaking Weight in tons.
$\frac{3}{4}$	$\frac{1}{9}$	$\frac{3}{4}$	$\frac{3}{4}$	1	$2\frac{1}{2}$
1	$\frac{1}{5}$	1	$1\frac{1}{2}$	$1\frac{1}{4}$	3
$1\frac{1}{2}$	$\frac{1}{2}$	$1\frac{1}{2}$	3	$1\frac{3}{8}$	4
2	$\frac{4}{5}$	$1\frac{3}{4}$	4	$1\frac{1}{2}$	$5\frac{3}{4}$
$2\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{7}{8}$	5	$1\frac{3}{4}$	$7\frac{1}{2}$
$2\frac{3}{4}$	$1\frac{1}{2}$	2	6	$1\frac{7}{8}$	9
3	$1\frac{4}{5}$	$2\frac{1}{8}$	$6\frac{1}{2}$	2	10
$3\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	7	$2\frac{1}{8}$	11
4	$3\frac{1}{5}$	$2\frac{3}{8}$	8	$2\frac{1}{4}$	$12\frac{1}{2}$
$4\frac{1}{2}$	4	$2\frac{1}{2}$	9	$2\frac{3}{8}$	14
5	5	$2\frac{5}{8}$	10	$2\frac{1}{2}$	$15\frac{1}{2}$
$5\frac{1}{2}$	6	$2\frac{3}{4}$	11	$2\frac{5}{8}$	17
6	$7\frac{1}{4}$	$2\frac{7}{8}$	13	$2\frac{3}{4}$	19
$6\frac{1}{2}$	$8\frac{1}{4}$	3	14	$2\frac{7}{8}$	21
7	$9\frac{3}{4}$	$3\frac{1}{8}$	15	3	$22\frac{1}{2}$
$7\frac{1}{2}$	$11\frac{1}{4}$	$3\frac{3}{8}$	17	$3\frac{1}{8}$	$24\frac{1}{2}$
8	13	$3\frac{1}{2}$	19	$3\frac{3}{8}$	$28\frac{1}{2}$
$8\frac{1}{2}$	$14\frac{1}{2}$	$3\frac{5}{8}$	21	$3\frac{1}{2}$	31
9	$16\frac{1}{4}$	$3\frac{3}{4}$	23	$3\frac{3}{4}$	35
$9\frac{1}{2}$	18	4	25	4	40
10	20	$4\frac{1}{4}$	29		
$10\frac{1}{2}$	22	$4\frac{5}{8}$	34		
11	24	5	38		
$11\frac{1}{2}$	$26\frac{1}{2}$	$5\frac{1}{2}$	46		
12	29	6	55		

The Strength of Flat Ropes.

Breaking Weight in tons.	Hemp. Size in inches.	Iron Wire. Size in inches.
11	4×1	$2\frac{1}{8} \times \frac{1}{2}$
12	$4\frac{1}{2} \times 1\frac{1}{8}$	$2\frac{1}{2} \times \frac{1}{2}$
15	$5 \times 1\frac{1}{4}$	$2\frac{3}{4} \times \frac{5}{8}$
18	$5\frac{1}{2} \times 1\frac{3}{8}$	$3 \times \frac{5}{8}$
$21\frac{1}{2}$	$6 \times 1\frac{1}{2}$	$3\frac{1}{2} \times \frac{5}{8}$
24	$7 \times 1\frac{7}{8}$	$4 \times \frac{5}{8}$
27	$8\frac{1}{4} \times 2\frac{1}{8}$	$4\frac{1}{2} \times \frac{5}{8}$
30	$8\frac{1}{2} \times 2\frac{1}{4}$	$5 \times \frac{5}{8}$

Rule for the Breaking Weight of Ropes.

The circumference in inches being represented by C.

The breaking weight in tons $= 0.2\ C^2$ for hemp.
$= 1.5\ C^2$ for iron wire.
$= 2.5\ C^2$ for steel wire.

The hemp ropes given in the rules and tables are supposed to be tarred. White ropes are about 5 per cent. stronger.

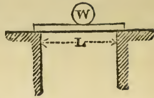
When ropes and chains are strained, as in the act of hauling, the tension arising from their own weight is greatly increased. Therefore add to the weight to be moved that of the rope or chain multiplied by the number opposite to the ratio of deflection from a straight line, as given in the following table.

Ratio of deflection....	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{15}$	$\frac{1}{14}$	$\frac{1}{13}$	$\frac{1}{12}$	$\frac{1}{11}$	$\frac{1}{10}$
Multiplier..	5.200	2.536	1.943	1.823	1.700	1.572	1.460	1.340

Factor of safety for ropes and chains $= \frac{1}{6}$.

Transverse Strength of Beams in General.

Supported at the ends and loaded in the middle—



b = Breadth in inches.
d = Depth in inches.
L = Length in feet.
W = Breaking weight in cwts.

$$W = C \frac{b d^2}{L}$$

C being the weight in cwts. required to fracture a bar 1 inch square and 1 foot long.

C = 25 wrought iron.
= 18 cast iron.
= 8 brass.
= 7 zinc.
= 7 teak.
= 5 ash and English oak.
= 5 pitch pine.
= 4 red pine, fir, and beech.
= 3 Riga fir.
= 3 elm and larch.

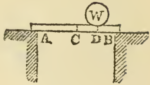
If the beam is fixed at one end and loaded in the middle—take $1\frac{1}{4}$ W.

If the beam is fixed at both ends and loaded in the middle—take $1\frac{1}{2}$ W.

If fixed at one end and loaded at the other—take $\frac{1}{4}$ W.

In all cases when the load is uniformly distributed, double the weight will be required to cause fracture, that would, if placed on the middle.

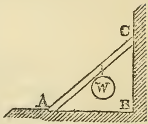
If the load is applied at any other point, as at D, the breaking weight will be equal to the square of half the length of A B multiplied by the breaking weight in the middle, and divided by the product of the distance A D and D B from each end.



When a beam is continued over three or more points and the load uniformly distributed, it will be sufficient to take the part between any two points of support as a beam *fixed at both ends.*

If some of the parts have a greater load than the others, it will be near enough in practice to take the parts so loaded as *supported at the ends* only.

Inclined beams supported at the ends have their breaking weight equal to that of the same beam when horizontal, multiplied by the length A C, and divided by the horizontal distance A B.



When the beam is Cylindrical, take the cube of the diameter instead of the breadth and square of the depth, and $\frac{5}{6}$th of W thus found will equal the breaking weight.

For Hollow Cylinders, take the *difference* of the cubes of the external and internal diameters, and proceed as for solid cylinders.

The foregoing general formulæ for the breaking weight of beams are only applicable when the breadth of the beam is to its depth as about 5 to 7, or where they can be kept from twisting by proper strutting.

The factor of safety to be adopted in practice, is $\frac{W}{4}$ for a fixed load, and $\frac{W}{6}$ for a moving load.

According to Tredgold, a strain greater than $\frac{1}{5}$th of the breaking weight on timber, causes the deflection to increase, and in course of time to produce a permanent set.

The Stiffness of Beams

Supported at the ends and loaded in the middle.

B = Breadth in inches.
d = Depth in inches.
L = Length in feet.
W = Load in cwts.
E = Deflection in inches.

$$E = \frac{L^3 Wa}{40 Bd^3}$$

For Cylinders

$$E = \frac{L^3 Wa}{24 D^4}$$

D being the diameter in inches.

a =	.067	wrought iron.
=	.112	cast iron.
=	.851	teak.
=	1.344	English oak.
=	1.008	Canadian oak.
=	1.120	Baltic oak.
=	1.120	yellow fir.
=	1.008	Memel fir.
=	1.232	red pine.
=	1.254	yellow pine.
=	1.176	ash.
=	1.434	beech.
=	1.904	elm.
=	1.300	mahogany.

If the beam is fixed at one end and loaded at the *other*—take 16 E.

If fixed at one end and *uniformly* loaded—take 6 E.

When supported at both ends and *uniformly* loaded—take $\frac{5}{8}$ E.

When fixed at both ends and loaded in the *middle*—take $\frac{1}{5}$ E.

When fixed at both ends and *uniformly* loaded—take $\frac{3}{40}$ E.

The deflection of a square or rectangular beam is to a cylindrical one as 1 to 1.7.

When the deflection E is taken at $\frac{1}{40}$th of an inch per foot in length. For a beam supported at both ends and loaded in the middle.

$$B = \frac{L^2 \, W a}{d^3}$$

$$d = \sqrt[3]{\frac{L^2 \, W a}{B}}$$

For Cylinders

$$D = \sqrt[4]{1.7 \, L^2 \, W a}$$

For an uniform load take $\frac{5}{8}$ W as before.

If the deflection is to be limited to one-half of $\frac{1}{40}$ of an inch per foot, multiply a by 2; if to one-third, multiply by 3, and so on.

Girders of Wood.

10 feet apart in floors.

B = Breadth in inches.
D = Depth in inches.
L = Length in feet.

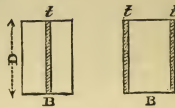
$$D = \sqrt[3]{\frac{L^2}{B}} \times 4.2 \text{ for fir ; or by } 4.34 \text{ for oak.}$$

$$B = \frac{L^2}{D^3} \times 74 \text{ fir ; or } 82 \text{ oak.}$$

To obtain the maximum stiffness, B should $= \frac{5}{7}$ D.

Girders of Wood with Wrought Iron Flitches.

B = Breadth of wood in inches.
D = Depth in inches.
t = Thickness of iron flitch in inches.
L = Length of bearing in ft.
W = Breaking weight in cwts. on the middle.



$$W = \frac{D^2}{L}(C\,B + 30t)$$

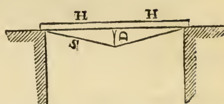
C = 4.0 teak.
= 3.0 oak.
= 2.5 fir.
= 2.0 elm.

Beams of Wood Trussed with Wrought Iron.

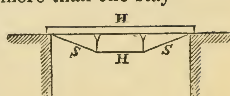
L = Length in feet } Measured from the points of intersection of stay, tension rod, and top beam.
D = Depth in feet }
W = Load in tons, uniformly distributed.
H = Horizontal thrust on beam in tons.
S = Strain on inclined part of tension rod in tons.

$$H = \frac{W\,L}{8\,D}$$

$$S = \sqrt{H^2 + \frac{W^2}{16}}$$



When the truss has more than one stay—
H will be as in fig 1., L and D being the same. The tensile strain on the horizontal part of the tie rod will also = H.



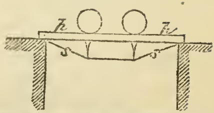
For the strain on the inclined tie we have

$$S = \frac{W}{8\,D}\sqrt{L^2 + n^2 D^2}$$

n being the number of times that the horizontal distance between the pier and the nearest stay is contained in L, *e.q.* it equals 2 in fig. 1 and 3 in fig. 2.

When the load is placed on the middle, the strain H will be doubled.

When a load = W is placed on each of the stays,



Let l = The distance of each loaded stay from the nearest pier.

D = Depth of truss as before.

h = Horizontal thrust on the part next the pier.

s = The tension on each of the inclined ties.

then $$h = \frac{W\,l}{D}$$

$$s = \sqrt{h^2 + W^2}$$

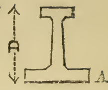
To resist the strains, S s with safety, allow one inch of sectional area in the tie rod for every 5 tons of strain.

The stay D being in compression, should be calculated as a column capable of supporting the load if in the middle, or one-half, if distributed.

The top beam though in compression from the strain H, should be capable of supporting the load between the stays as a beam exposed to transverse strain, the rules for obtaining the strength of which have been already given.

Girders of Cast Iron.

A = Area of bottom flange in inches.
D = Depth of girder in inches.
L = Length of bearing in feet.
W = Breaking weight in tons on the middle.



$$W = 2\frac{A\ D}{L} = \left\{\begin{array}{l}\text{breaking weight in tons}\\ \text{on the middle.}\end{array}\right.$$

Area of top flange should $= \frac{A}{3}$ when the load is on the top.

Ditto " $= \frac{A}{6}$ when the load is on the bottom flange.

The depth at the ends may be reduced to $\frac{2}{3}$ D in the form of an elliptic curve for the top. If the top and bottom are horizontal, the width of the bottom flange may be reduced from the centre to the ends in the form of a parabolic curve.

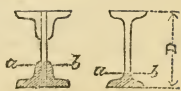
Safe load when stationary $= \frac{W}{5}$

Ditto " moving $= \frac{W}{8}$

Proof load should not exceed $\frac{W}{3}$

Girders of Wrought Iron.

A = Area of bottom flange in inches (part below line $a\,b$).
D, L, and W as for girders of cast iron.



When D is more than $\frac{L}{14}$

$$W = C\frac{A\,D}{L} = \left\{\begin{array}{l}\text{breaking weight in tons}\\ \text{on middle.}\end{array}\right.$$

C=6.0 for plate girders.
6.5 " box girders.
6.0 " rolled girders.
4.0 " T girders.

Area of top flange should =1.75 A.

Width of top flange for depths under 12 in.$=\frac{D}{2}$

Ditto " " over 12 in.$=\frac{D}{3}$

With the latter proportion, feathers or stiffening pieces should be used to supply the deficiency in lateral stiffness occasioned by the reduced width of flange.

Usual thickness of web for all depths under 3 feet$=\frac{3}{8}$ inch.

Safe load when stationary$=\frac{W}{4}$

Ditto " moving$=\frac{W}{6}$

Ditto " $D=\frac{L}{15}=\frac{W}{4.5}$

Ditto " $D=\frac{L}{16}=\frac{W}{5}$

Ditto " $D=\frac{L}{18}=\frac{W}{6.5}$

Ditto " $D=\frac{L}{20}=\frac{W}{8}$

Ditto " $D=\frac{L}{22}=\frac{W}{10}$

Ditto " $D=\frac{L}{25}=\frac{W}{12.5}$

Ditto " $D=\frac{L}{30}=\frac{W}{18}$

It is usual to camber a riveted girder so that on receiving the permanent load it may become nearly horizontal.

If the required rise or camber in the middle $=E$ in inches, D being in inches, and L in feet as before, we have

$$E=K\frac{L^2}{D}$$

For girders uniformly loaded, and of uniform section throughout the length, $K=.018$.

Ditto, when the section is made to vary so that the girder will be of equal strength throughout, $K=.021$

FLOORS.
(Tredgold.)

$L=$Length in feet.
$B=$Breadth in inches.
$D=$Depth in inches.

Binding Joists.
6 feet apart.

$D=\sqrt[3]{\frac{L^2}{B}}\times 3.42$ for fir, or 3.53 for oak.

$B=\frac{L^2}{D^3}\times 40$ for fir, or 44 for oak.

Single or Bridging Joists.

12 inches from centre to centre.

$$D=\sqrt[3]{\frac{L^2}{B}}\times 2.2 \text{ fir, or } 2.3 \text{ oak.}$$

Trimmers are usually calculated as binding joists of the same bearing.

Trimming joists are taken as single joists with the addition of $\frac{1}{8}$ inch to their thickness for every joist carried by the trimmer.

When the bearing of single joists exceeds 8 feet, they should be strutted to prevent their twisting, and for each increase of 4 feet in the bearing there should be an additional row of struts.

Scantlings for Single Joists of Yellow Fir.

Distance from middle to middle=12 inches.

Length of bearing in feet.	Breadth in inches.			
	$1\frac{3}{4}$	2	$2\frac{1}{2}$	3
	Depth. "	Depth. "	Depth. "	Depth. "
5	$5\frac{1}{2}$	$5\frac{1}{4}$	$4\frac{3}{4}$	$4\frac{3}{8}$
6	6	$5\frac{3}{4}$	$5\frac{3}{8}$	5
7	$6\frac{3}{4}$	$6\frac{1}{2}$	6	$5\frac{1}{2}$
8	$7\frac{1}{2}$	7	$6\frac{1}{2}$	$6\frac{1}{4}$
9	$7\frac{7}{8}$	$7\frac{1}{2}$	$6\frac{7}{8}$	$6\frac{1}{2}$
10	$8\frac{1}{2}$	8	$7\frac{1}{2}$	7
12	$9\frac{3}{4}$	$9\frac{1}{2}$	$8\frac{1}{2}$	8
14	$10\frac{1}{2}$	10	$9\frac{1}{2}$	9
16	$11\frac{1}{2}$	11	$10\frac{1}{2}$	$9\frac{3}{4}$
18	$12\frac{1}{2}$	12	$11\frac{1}{4}$	$10\frac{1}{2}$
20	$13\frac{1}{2}$	13	12	$11\frac{1}{4}$
25	$15\frac{1}{2}$	15	14	13

Ceiling Joists.

12 inches from centre to centre.

$$D=\frac{L}{\sqrt[3]{B}}\times 0.64 \text{ fir, or } 0.67 \text{ oak.}$$

$$\sqrt[3]{1\tfrac{1}{2}}=1.145.$$
$$\sqrt[3]{1\tfrac{3}{4}}=1.205.$$
$$\sqrt[3]{2}=1.260.$$
$$\sqrt[3]{2\tfrac{1}{2}}=1.357.$$

2 inches is the usual thickness (B) for ceiling joists, in which case the depth will equal $\frac{1}{2}$ inch per foot in length of bearing.

Lintels over Openings.

Take $1\frac{1}{4}$ inches in depth for every foot of bearing.

The Weight which Floors have usually to Sustain.

	per foot superficial.
Ordinary dwelling house floors should be calculated to sustain, including the weight of the floor itself........	$1\frac{1}{4}$ cwt.
Public buildings, lecture rooms, &c.......	$1\frac{1}{2}$ "
Warehouses, factories, &c..................	$2\frac{1}{2}$ "

Columns of Wood.

D = Diameter in inches.
L = Length in feet.
W = Safe load in cwts. $=\frac{1}{10}$ breaking weight.

Round columns :

$$W=E\,\frac{D^4}{L^2}$$

Square columns :

$$W = 1.7\ E\,\frac{S^4}{L^2}$$

S being the side in inches.

Rectangular columns :

$$W = 1.7\ E\,\frac{B\,T^3}{L^2}$$

B = the breadth and T = the least thickness in inches.

E = 15.0 for teak.
= 14.0 " English oak.
= 13.0 " Canadian oak.
= 12.0 " Baltic oak.
= 12.0 " red pine.
= 11.0 " Riga fir.
= 12.0 " ash.
= 11.0 " beech.
= 9.0 " larch.
= 8.0 " elm.

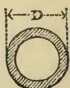
Struts of Wrought Iron.

(Rankine.)

D = Diameter in inches.
L = Length in inches.
S = Sectional area of metal in inches.
W = Crushing weight in tons.

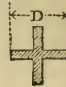
When fixed at the ends :

$$W = 16\,S \div 1 + \frac{L^2}{aD^2}$$

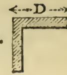


$a = 3000$ for a hollow tube.

$=1000$ for a cross with equal arms.



$=1000$ for an angle with equal sides.



When hinged at the ends:

Take $\frac{a}{4}$

Columns of Cast Iron.
(Hodgkinson.)

Ends flat and fixed.

D $=$ Diameter in inches.
L $=$ Length in feet.
W $=$ Crushing weight in tons.
When L exceeds 30 D

$$\text{Solid columns } W = 44\,\frac{D^{3.6}}{L^{1.7}}$$

$$\text{Hollow columns } W = 44\,\frac{D^{3.6} - d^{3.6}}{L^{1.7}}$$

d being the internal diameter in inches.
When the ends are rounded take $\frac{1}{3}$ W.
When L is less than 30 D
W $=$ Crushing weight, as above, in tons.
w $=$ Crushing weight of short column in tons.
S $=$ Sectional area of solid part of column in inches.

$$w = \frac{49\,W\,S}{W + 37\,S}$$

In hollow columns the thickness of metal should not be less than $\frac{D}{12}$

Professor Gordon's Rules.

Take L=Length in *inches*.

Then for ROUND HOLLOW COLUMNS, when the ends are flat and fixed,

$$W = \frac{36\ S}{1 + \frac{L^2}{400\ D^2}}$$

When the section is a HOLLOW SQUARE, and the diagonal=D,

$$W = \frac{36\ S}{1 + \frac{3\ L^2}{800\ D^2}}$$

When the section is a CROSS, D being the diameter from end to end of the shortest pair of arms,

$$W = \frac{36\ S}{1 + \frac{3\ L^2}{400\ D^2}}$$

When the ends are hinged, take 100 D^2 instead of 400 D^2 and 200 D^2 instead of 800 D^2 in the above formulæ.

In order to give lateral stiffness to flat-ended pillars, the ends should spread so as to form a capital and base, and when they are in two or more lengths, the joints should be made truly plane and perpendicular to the axis.

Factor of safety=$\frac{1}{10}$.

Table of Hollow Cast-Iron Columns.

The ends being flat and fixed, calculated at about $\frac{1}{10}$th of the breaking weight as indicated by Hodgkinson's experiments.

Thickness of metal = $\frac{1}{2}$-inch.

External Diameter in inches.	Length in feet. 6	8	10	12	14	16	18	20	25
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
3	5.8	4.0	3.2	2.3	1.8	1.4	1.2	1.0	.7
3½	8.2	5.9	5.1	3.6	2.7	2.3	1.9	1.5	.9
4	10.9	8.1	6.1	4.7	3.6	3.4	2.8	2.0	1.5
4½	13.8	10.6	8.1	6.5	5.0	4.4	3.9	3.1	2.0
5	16.8	13.3	10.4	8.3	6.7	5.4	5.0	4.0	2.7
5½	19.8	15.3	12.9	10.5	8.5	7.0	6.2	5.2	3.5
6	22.9	19.0	15.5	12.7	9.5	8.7	7.3	6.2	4.3
6½	26.0	22.0	18.3	15.2	12.4	10.7	9.1	7.7	5.4
7	29.1	25.0	21.2	17.9	15.1	12.8	10.9	9.3	6.5
7½	32.2	28.1	24.2	20.6	17.6	15.0	12.9	11.1	7.9
8	35.3	31.2	27.1	23.4	20.2	17.4	15.0	13.1	9.4
8½	38.4	34.3	30.2	26.3	22.9	19.9	17.3	15.1	11.0
9	41.4	37.4	33.3	29.4	25.6	22.5	19.7	17.4	12.7
Thickness of metal = $\frac{5}{8}$-inch.									
3	6.9	4.7	3.5	2.6	2.0	1.6	1.3	1.0	.8
3½	9.9	7.1	5.3	4.2	3.2	2.5	2.1	1.8	1.2
4	13.2	9.2	7.3	5.6	4.4	3.9	3.2	2.7	1.8
4½	16.7	12.8	9.9	7.7	6.1	5.5	4.5	3.8	2.6
5	20.4	16.1	12.7	9.1	8.1	7.0	6.0	4.9	3.5
5½	24.1	18.7	15.7	12.8	10.4	8.8	7.5	6.3	4.7
6	28.0	23.2	19.0	15.6	12.8	10.6	9.0	7.6	5.8
6½	31.8	26.9	22.4	18.7	15.2	13.0	11.0	9.4	7.6
7	35.6	30.7	26.0	21.9	18.5	15.6	13.3	11.4	9.0
7½	40.5	34.5	29.7	25.3	21.6	18.4	15.8	13.6	11.0
8	43.4	38.4	33.4	28.8	24.8	21.4	18.5	16.1	13.0
8½	47.0	42.2	37.1	32.4	28.2	24.5	21.3	18.6	15.5
9	51.6	46.1	41.0	36.2	31.5	27.7	24.3	21.3	18.1

Cast-Iron Columns (*continued*).

Thickness of metal = $\frac{3}{4}$-inch

External Diameter in inches.	Length in feet.								
	6	8	10	12	14	16	18	20	25
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
3	7.8	5.4	3.8	2.8	2.2	1.7	1.4	1.1	.8
$3\frac{1}{2}$	11.3	8.1	6.2	4.4	3.5	2.6	2.1	1.9	1.3
4	15.2	11.3	8.5	6.5	4.8	3.8	3.3	2.8	1.8
$4\frac{1}{2}$	19.4	14.9	11.5	8.9	7.2	6.0	5.0	4.1	2.7
5	23.7	18.8	14.8	11.7	9.0	7.7	6.5	5.7	3.8
$5\frac{1}{2}$	28.2	21.8	18.4	14.9	12.1	10.2	8.6	7.2	5.3
6	32.8	27.2	22.3	18.3	15.0	12.5	10.5	8.8	6.4
$6\frac{1}{2}$	37.3	31.6	26.3	21.9	17.8	15.3	12.0	10.7	8.0
7	41.9	36.1	30.6	25.8	21.7	18.4	15.7	12.6	9.0
$7\frac{1}{2}$	46.5	40.6	35.0	29.8	25.4	21.7	18.6	15.6	11.5
8	51.1	45.3	39.3	34.0	29.3	25.2	21.8	18.7	13.7
$8\frac{1}{2}$	55.7	49.8	43.8	38.3	33.3	28.9	25.1	21.9	15.9
9	60.3	54.4	48.5	42.8	37.2	32.7	28.7	24.2	18.4
	Thickness of metal = $\frac{7}{8}$-inch.								
4	16.1	12.7	9.5	7.3	5.7	4.6	3.8	3.2	2.0
$4\frac{1}{2}$	21.9	16.6	12.9	10.1	8.0	6.7	5.5	4.5	3.1
5	26.9	21.3	16.7	13.3	10.7	8.8	7.4	6.1	4.1
$5\frac{1}{2}$	32.0	24.8	20.9	16.9	13.7	11.5	9.5	7.8	5.3
6	37.3	31.0	25.4	20.8	17.1	14.2	12.0	10.2	7.0
$6\frac{1}{2}$	42.6	36.0	30.1	25.1	20.4	17.5	14.9	12.7	8.8
7	47.7	41.0	34.7	29.2	24.6	20.9	17.8	15.2	10.8
$7\frac{1}{2}$	53.3	46.5	40.0	34.1	29.1	24.8	21.3	18.4	13.1
8	58.6	51.9	45.1	39.0	33.6	28.9	25.0	21.8	16.7
$8\frac{1}{2}$	64.0	57.2	50.4	44.0	38.2	33.2	28.9	25.2	18.4
9	69.3	62.6	55.7	49.1	42.7	37.5	32.9	28.9	21.2
10	79.9	73.4	66.5	59.5	53.0	47.0	41.7	37.0	27.9

Cast-Iron Columns (*continued*).

Thickness of metal = 1-inch.

External Diameter in inches.	Length in feet.								
	6	8	10	12	14	16	18	20	25
	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.
4	18.7	13.9	10.4	8.0	6.4	4.8	3.9	3.3	2.3
$4\frac{1}{2}$	24.2	18.5	14.3	11.1	8.8	7.1	5.8	4.8	3.2
5	29.9	23.6	18.6	14.8	11.9	9.6	7.6	6.5	4.6
$5\frac{1}{2}$	35.6	27.6	23.2	18.9	15.3	12.7	10.3	8.8	6.0
6	41.6	34.5	28.3	23.2	19.1	15.9	13.3	11.3	7.6
$6\frac{1}{2}$	47.7	40.3	33.6	28.0	22.8	19.6	16.6	14.2	9.1
7	53.7	46.2	39.1	33.0	27.8	23.6	20.1	17.2	11.0
$7\frac{1}{2}$	59.7	52.2	44.9	38.3	32.6	27.9	23.9	20.6	13.3
8	65 9	58.3	50.7	43.8	37.7	32.5	28.1	24.4	16.4
$8\frac{1}{2}$	71.9	64.3	56.5	49.4	42.9	37.3	32.4	28.3	19.5
9	78.0	70.5	62.7	55.3	48.1	42.3	37.1	32.6	23.0
10	90.2	82.8	75.0	67.1	59.7	53.0	47.0	41.7	31.4
11	102.1	95.1	87.1	79.1	71.4	64.2	57.6	51.6	39.5
12	115.1	107.3	97.0	91.6	82.9	76.0	68.8	62.2	48.4
	Thickness of metal = $1\frac{1}{4}$-inches.								
$4\frac{1}{2}$	28.1	21.5	16.5	12.9	10.2	7.6	6.2	5.2	3.4
5	34.9	27.6	21.7	17.2	13.9	10.8	8.8	7.4	4.6
$5\frac{1}{2}$	42.1	32.6	27.5	22.3	18.0	14.6	12.0	10.0	6.8
6	49.4	41.0	33.6	27.5	22.7	18.8	15 8	13.4	8.8
$6\frac{1}{2}$	56.8	48.0	40.0	34.4	27.1	23.3	19.8	16.9	11.0
7	64.3	55.4	46.9	39.5	33.3	28.3	24.2	20.6	14.0
$7\frac{1}{2}$	71.8	62.7	54.0	46.0	39.3	33.5	28.7	24.8	17.4
8	79.3	70.2	61.1	51.7	45.4	39.1	33.8	29.4	21.2
$8\frac{1}{2}$	87.0	77.8	68.4	59.7	51.9	45.1	39.2	34.2	24.8
9	94.5	85.3	75.9	66.9	58.3	51.2	44.9	39.4	28.9
10	109.6	100.7	91.2	81.6	72.6	64.3	57.2	50.7	38.1
11	124.6	115.8	106.2	96.5	87.1	78.2	70.2	63.0	48.3
12	140.6	131.1	118.6	111.9	101.3	92.9	84.0	76.0	59.1

Cast Iron Columns (*continued*).

Thickness of Metal = $1\frac{1}{2}$ inches.

External Diameter in inches.	Length in feet.								
	6	8	10	12	14	16	18	20	25
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
6	56.2	46.6	38.2	31.3	25.9	21.4	18.0	15.3	10.6
$6\frac{1}{2}$	64.9	55.0	45.9	38.2	31.1	26.7	22.7	19.4	13.5
7	73.7	63.5	53.7	45.3	38.2	32.4	27.6	23.7	16.7
$7\frac{1}{2}$	82.8	72.3	62.3	53.3	45.2	38.6	33.1	28.6	20.4
8	91.6	81.2	70.6	61.0	52.4	45.1	39.0	33.9	24.4
$8\frac{1}{2}$	100.7	90.1	79.2	69.1	60.1	52.2	45.4	39.6	28.9
9	109.7	99.1	88.1	77.7	67.6	59.4	52.1	45.7	33.6
10	127.8	117.3	106.3	95.1	84.7	75.1	66.6	59.1	44.4
11	145.7	135.5	124.3	112.9	101.9	91.5	82.1	73.7	56.4
12	164.9	153.6	139.0	131.2	118.8	108.9	98.5	89.1	69.3
	Solid.								
2	2.3	1.4	1.0	.7	.50	.44	.36	.30	.20
$2\frac{1}{4}$	2.8	2.1	1.5	1.0	.83	.66	.54	.46	.31
$2\frac{1}{2}$	4.6	2.9	2.1	1.6	1.21	.95	.80	.66	.56
$2\frac{3}{4}$	6.5	4.0	3.0	2.2	1.72	1.35	1.11	.94	.64
3	8.9	6.0	4.0	3.0	2.30	1.84	1.50	1.28	.88

The Relative Strength of Columns of Steel, Iron, and Wood.

Steel..............	=180	English oak......	= 18
Cast iron	=100	Red pine	= 15
Wrought iron...	= 79	Larch	= 12
Teak..............	= 19	Elm	= 10

Pillars of Stone and Brick.

The Weight to produce Fracture per superficial foot.

	Tons.
Granite, Aberdeen	500
,, Dartmoor	450
,, Peterhead	400
Slate	450
Marble and limestone	400
Yorkshire sandstone	350
Craigleith ,,	200
Magnesian limestone (Roach Abbey)	100
Portland oolite	130
Bath ,,	80
Concrete (made with lime) in foundations	24
Chalk	10
Brick, ordinary	40
,, strong well burnt	70
,, fire	100
Brickwork in cement	30
,, ,, mortar	20
Rubble masonry	20

No pillar or support of stone or brick should exceed in height 12 times its least thickness at the base; when more than this there is a considerable falling off in strength. A height of 24 times the thickness reduces the strength from 10 to 7, when increased to 30 times the strength is reduced to one-half, and when increased to 40 times the strength is reduced to one-third.

In practice the safe load should seldom exceed one-tenth of that required to produce fracture.

TORSION.

Let D = Diameter of shaft in inches.
W = Weight in lbs. permanently sustained by shaft.
L = Length of lever in feet at the end of which W acts.

Then
$$D=\sqrt[3]{\frac{W\,L}{C}} \qquad W=\frac{C\,D^3}{L}$$

When the shaft is square, S = side in inches.

$$S=\sqrt[3]{\frac{4\,W\,L}{5\,C}}$$

C = 590 for cast steel.
= 335 „ wrought iron.
= 330 „ cast iron.
= 170 „ gun metal.
= 150 „ brass.
= 135 „ copper.
= 34 „ lead.

SIZE OF TIMBER ROOFING.
(TREDGOLD.)

A = Area of section in inches.
B = Breadth in inches.
D = Depth in inches.
L = Length of piece in feet.
S = Span of roof in feet.

KING POST.

$A = L\,S \times 0.12$ for fir, or by 0.13 for oak.

$$B=\frac{A}{D} \qquad D=\frac{A}{B}$$

QUEEN POST.

$A = L\,p \times 0.27$ fir, or 0.32 oak.

p being the length in feet of that part of tie beam supported by the queen post.

Tie Beam.

$$D = \frac{l}{\sqrt[3]{B}} \times 1.47 \text{ fir, or } 1.52 \text{ oak.}$$

l being the length in feet of the longest unsupported part.

Principal Rafters.

When there is a king post

$$D = \frac{L^2 S}{B^3} \times 0.96 \text{ fir.}$$

When there are two queen posts

$$D = \frac{L^2 S}{B^3} \times 0.155 \text{ fir.}$$

Straining Beam.

Let its depth be to its thickness as 10 to 7, or as near to this proportion as possible.

$$D = \sqrt{L\,S^{\frac{1}{2}}} \times 0.9 \text{ fir.}$$

$$B = 0.7\,D.$$

Struts and Braces.

$$D = \sqrt{L\,p^{\frac{1}{2}}} \times 0.8 \text{ fir.}$$

$$B = 0.6\,D.$$

p being the length in feet of that part of the principal rafter supported by the strut.

Purlins.

$$D = \sqrt[4]{L^3 C} \text{ fir, or } \times \text{ by } 1.04 \text{ for oak.}$$

$$B = 0.6\,D.$$

C being the distance in feet that the purlins are apart.

Common Rafters.

$$D = \frac{L}{B^{\frac{1}{3}}} \times 0.72 \text{ fir, or } 0.74 \text{ oak.}$$

Two inches is the best thickness for common rafters, in which case

$$D = .571\,L \text{ for fir.}$$

Table of Scantlings.—Wood Roofs.

Span in feet.	Tie Beam.	King Post.	Qneen Posts.	Small Queens.	Principal Rafters.	Straining Beam.	Braces.	Purlins.	Common Rafters.
	in. in.	in. in.	in. in.	in. in.	in. in.	in. in.	in. in.	in. in.	in. in.
20	$9\frac{1}{2}\times4$	4×3			4×4		$3\frac{1}{2}\times2$	$8\times4\frac{3}{4}$	$3\frac{1}{2}\times2$
22	$9\frac{1}{2}\times5$	5×3			5×3		$3\frac{3}{4}\times2\frac{1}{4}$	$8\frac{1}{4}\times5$	$3\frac{3}{4}\times2$
24	$10\frac{1}{2}\times5$	$5\times3\frac{1}{2}$			$5\times3\frac{1}{2}$		$4\times2\frac{1}{2}$	$8\frac{1}{2}\times5$	4×2
26	$11\frac{1}{2}\times5$	5×4			$5\times4\frac{1}{4}$		$4\frac{1}{4}\times2\frac{1}{2}$	$8\frac{3}{4}\times5$	$4\frac{1}{4}\times2$
28	$11\frac{1}{2}\times6$	6×4			$6\times3\frac{1}{2}$		$4\frac{1}{2}\times2\frac{3}{4}$	$8\frac{3}{4}\times5\frac{1}{4}$	$4\frac{1}{2}\times2$
30	12×6	$6\times4\frac{1}{2}$			6×4		$4\frac{3}{4}\times3$	$9\times5\frac{1}{2}$	$4\frac{3}{4}\times2$
32	$10\times4\frac{1}{2}$		$4\frac{1}{2}\times4$		$5\times4\frac{1}{2}$	$6\frac{3}{4}\times4\frac{1}{2}$	$3\frac{3}{4}\times2\frac{1}{4}$	$8\times4\frac{3}{4}$	$3\frac{1}{2}\times2$
34	10×5		$5\times3\frac{1}{2}$		5×5	$6\frac{3}{4}\times5$	$4\times2\frac{1}{2}$	$8\frac{1}{4}\times5$	$3\frac{3}{4}\times2$
36	$10\frac{1}{2}\times5$		5×4		$5\times5\frac{3}{4}$	7×5	$4\frac{1}{4}\times2\frac{1}{2}$	$8\frac{1}{2}\times5$	4×2
38	10×6		$6\times3\frac{3}{4}$		6×6	$7\frac{1}{4}\times6$	$4\frac{1}{2}\times2\frac{1}{2}$	$8\frac{1}{2}\times5$	4×2
40	11×6		6×4		6×6	8×6	$4\frac{1}{2}\times2\frac{1}{3}$	$8\frac{3}{4}\times5$	$4\frac{1}{4}\times2$
42	$11\frac{1}{2}\times6$		$6\times4\frac{1}{2}$		$6\frac{1}{4}\times6$	$8\frac{1}{4}\times6$	$4\frac{1}{2}\times2\frac{3}{4}$	$8\frac{3}{4}\times5\frac{1}{4}$	$4\frac{1}{2}\times2$
44	12×6		6×5		$6\frac{1}{2}\times6$	$8\frac{1}{2}\times6$	$4\frac{1}{2}\times3$	9×5	$4\frac{3}{4}\times2$
46	$12\frac{1}{2}\times6$		$6\times5\frac{1}{2}$		7×6	9×6	$4\frac{3}{4}\times3$	$9\times5\frac{1}{2}$	5×2
48	$11\frac{1}{2}\times6$		$6\times5\frac{3}{4}$	$6\times2\frac{1}{4}$	$7\frac{1}{2}\times6$	$8\frac{1}{4}\times6$	$4\frac{1}{2}\times2\frac{3}{4}$	$8\frac{1}{2}\times5$	4×2
50	12×6		$6\times6\frac{1}{4}$	$6\times2\frac{1}{2}$	$8\frac{1}{2}\times6$	$8\frac{1}{2}\times6$	$4\frac{1}{2}\times2\frac{3}{4}$	$8\frac{3}{4}\times5$	$4\frac{1}{4}\times2$
52	$12\times6\frac{1}{2}$		$6\times6\frac{3}{4}$	$6\times2\frac{3}{4}$	$9\frac{1}{4}\times6$	$8\frac{3}{4}\times6$	$4\frac{3}{4}\times2\frac{3}{4}$	$8\frac{3}{4}\times5\frac{1}{4}$	$4\frac{1}{4}\times2$
54	12×7		$7\times6\frac{1}{4}$	$7\times2\frac{1}{4}$	$6\frac{1}{2}\times7$	9×6	$4\frac{3}{4}\times2\frac{3}{4}$	$8\frac{3}{4}\times5\frac{1}{4}$	$4\frac{1}{2}\times2$
56	12×8		$7\times6\frac{3}{4}$	$7\times2\frac{1}{2}$	$7\frac{1}{2}\times7$	$9\frac{1}{4}\times6$	$5\times2\frac{3}{4}$	$8\frac{3}{4}\times5\frac{1}{4}$	$4\frac{1}{2}\times2$
58	$12\times8\frac{1}{2}$		$7\times7\frac{1}{4}$	$7\times2\frac{3}{4}$	$8\frac{1}{4}\times7$	$9\frac{1}{2}\times7$	$5\times2\frac{3}{4}$	$9\times5\frac{1}{4}$	$4\frac{3}{4}\times2$
60	12×9		$7\frac{1}{2}\times7$	7×3	9×7	10×7	5×3	$9\times5\frac{1}{2}$	$4\frac{3}{4}\times2$

Trusses, 10 feet apart; Pitch, 27°; Covering, Slate; Timber, Yellow Fir.

Common Rafters.

12 inches apart from centre to centre.

Bearing in feet.	Breadth in inches.				
	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	3
	Depth, inches.	Depth, inches.	Depth, inches.	Depth, inches.	Depth, inches.
5	3	$2\frac{7}{8}$	$2\frac{3}{4}$		
8	$4\frac{3}{4}$	$4\frac{5}{8}$	$4\frac{3}{8}$	$4\frac{1}{4}$	4
10	6	$5\frac{3}{4}$	$5\frac{1}{2}$	$5\frac{3}{8}$	5
12	7	$6\frac{3}{4}$	$6\frac{1}{2}$	$6\frac{3}{8}$	6
14	$8\frac{1}{4}$	8	$7\frac{3}{4}$	$7\frac{1}{2}$	7
16	$9\frac{1}{2}$	$9\frac{1}{4}$	$8\frac{3}{4}$	$8\frac{1}{2}$	8
18	$10\frac{1}{2}$	$10\frac{1}{4}$	10	$9\frac{1}{2}$	9
20	$11\frac{3}{4}$	$11\frac{1}{2}$	11	$10\frac{1}{2}$	10

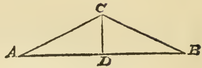
Purlins

Of Yellow Fir. Covering Slate.

Bearing in feet.	Distance apart in feet.			
	6	7	8	9
	Depth. Breadth.	Depth. Breadth.	Depth. Breadth.	Depth. Breadth.
6	6″ × $3\frac{1}{2}$″	$6\frac{1}{4}$″ × $3\frac{3}{4}$″	$6\frac{1}{2}$″ × 4″	$6\frac{3}{4}$″ × $4\frac{1}{4}$″
7	$6\frac{3}{4}$ × 4	7 × $4\frac{1}{4}$	$7\frac{1}{4}$ × $4\frac{1}{2}$	$7\frac{1}{2}$ × $4\frac{1}{2}$
8	$7\frac{1}{2}$ × $4\frac{1}{2}$	$7\frac{3}{4}$ × $4\frac{3}{4}$	8 × $4\frac{3}{4}$	$8\frac{1}{4}$ × 5
9	$8\frac{1}{4}$ × 5	$8\frac{1}{2}$ × $5\frac{1}{4}$	$8\frac{3}{4}$ × $5\frac{1}{4}$	9 × $5\frac{1}{2}$
10	$8\frac{3}{4}$ × $5\frac{1}{4}$	$9\frac{1}{4}$ × $5\frac{1}{2}$	$9\frac{1}{2}$ × $5\frac{3}{4}$	$9\frac{3}{4}$ × $5\frac{3}{4}$
11	$9\frac{1}{2}$ × $5\frac{3}{4}$	$9\frac{3}{4}$ × $5\frac{3}{4}$	$10\frac{1}{4}$ × 6	$10\frac{1}{2}$ × $6\frac{1}{4}$
12	10 × 6	$10\frac{1}{2}$ × $6\frac{1}{4}$	$10\frac{3}{4}$ × $6\frac{1}{2}$	$11\frac{1}{4}$ × $6\frac{3}{4}$
13	$10\frac{3}{4}$ × $6\frac{1}{2}$	$11\frac{1}{4}$ × $6\frac{3}{4}$	$11\frac{1}{2}$ × 7	12 × $7\frac{1}{4}$
14	$11\frac{1}{4}$ × $6\frac{3}{4}$	$11\frac{3}{4}$ × 7	$12\frac{1}{4}$ × $7\frac{1}{2}$	$12\frac{1}{2}$ × $7\frac{1}{2}$

Iron Roofs.

To find the strains on a simple truss (*fig.* 1).



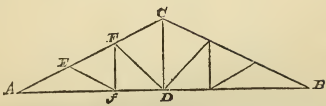
Let S = The half span A D.
R = The rise C D.
H = The tension on the tie rod.
T = The thrust along the rafter A C.
W = The gross weight of the roof.

then,

$$H = \frac{W S}{4 R}$$

$$T = \sqrt{H^2 + \frac{W^2}{16}} = \frac{W}{4}\sqrt{\frac{S^2}{R^2} + 1}$$

There is no strain on the king bolt C D, when the tie rod is horizontal, except that arising from the tendency of the tie rod to sag in the middle.



When the roof is trussed at one or more points on each side of the ridge, as at E and F

Let H and T equal the tension on the tie rod and the thrust on the rafter as for a simple truss (*fig.* 1), and

N = The number of divisions of the rafter formed by the secondary trusses, as C F, F E, and E A = 3 in the diagram.

The strain on the tie rod at the middle point $D = H$

Ditto, on part $f\,D = H\left(1+\frac{1}{N}\right)$

Ditto, on part $A\,f = H\left(1+\frac{2}{N}\right)$

And so on for any number of parts N, into which the rafter may be divided.

The thrust on the part of the rafter $F\,C = T\left(1+\frac{1}{N}\right)$

Ditto, on part $E\,F = T\left(1+\frac{2}{N}\right)$

Ditto, on part $A\,E = T\left(1+\frac{3}{N}\right)$

The weight suspended by any queen bolt, C D, or F f

$$= W\frac{N-m-1}{4\,N}$$

m being the number of divisions on the rafter distant from the ridge.

The strain on each strut F D and E f,

$$= \frac{W}{4\,N}\sqrt{\frac{S^2}{R^2}+(N-m)^2}$$

The strains will all be in terms of W, which may be taken in lbs., cwts., or tons—and the proportions of the several parts may be calculated to resist those strains according to the rules previously given for struts and ties.

When the tie rod is cambered the strains are increased. They may be readily obtained for any particular case by letting fall a vertical line, say from the points E and F. Take any portion of it to represent the weight on the division of the roof A E, or E F, &c. Parallel to the rafter draw another line to the strut, and from the point of intersection on the strut and parallel to the tie rod draw a line back to the vertical, and the several lines thus drawn, if measured off with the same scale will give the strains on the parts of the roof to which they are parallel.

PROPORTIONS OF WROUGHT IRON ROOFS

Usually adopted in practice.

Rise = $\frac{1}{5}$ to $\frac{1}{4}$ of span.
Camber of tie rod = $\frac{1}{15}$th of span.
Distance apart of principals = 6 to 7-feet.

TIE RODS AND KING BOLTS.

Span of Roof.	Diameter of T. R.	Diameter of K. B.
20 to 25-feet............	1 inch	$\frac{3}{4}$ inch
25 to 30 „	$1\frac{1}{8}$ „	$\frac{7}{8}$ „
30 to 35 „	$1\frac{1}{6}$ „	$\frac{7}{8}$ „
35 to 40 „	$1\frac{1}{4}$ „	1 „
40 to 45 „	$1\frac{3}{8}$ „	$1\frac{1}{8}$ „
45 to 50 „	$1\frac{1}{2}$ „	$1\frac{1}{4}$ „
50 to 60 „	$1\frac{3}{4}$ „	$1\frac{3}{8}$ „

Note.—The tie rod may be reduced from the ends to the middle $\frac{1}{8}$th inch in diameter for each division of the tie rod formed by the queen bolts.

Queen Bolts.

Span of Roof.	No.	Diameter.		
		First pair.	Second pair.	Third pair.
20 to 25-feet...	2	$\frac{5}{8}$ inch	—	—
25 to 30 ,, ...	2	$\frac{3}{4}$,,	—	—
30 to 35 ,, ...	2	$\frac{3}{4}$,,	—	—
35 to 40 ,, ...	4	$\frac{3}{4}$,,	$\frac{5}{8}$ inch	—
40 to 45 ,, ...	4	$\frac{7}{8}$,,	$\frac{3}{4}$,,	—
45 to 50 ,, ...	4	1 ,,	$\frac{7}{8}$,,	—
50 to 60 ,, ...	6	$1\frac{1}{8}$,,	$\frac{7}{8}$,,	$\frac{3}{4}$ inch

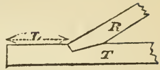
Struts of ⊤ Iron.

Span of Roof.	No.	Depth.	Sect. area of top table.	Sect. area of web.
20 to 25 feet...	2	2-inch	0.4 inch	0.5 inch
25 to 30 ,, ...	2	2 ,,	0.5 ,,	0.6 ,,
30 to 35 ,, ...	4	$2\frac{1}{4}$,,	0.5 ,,	0.9 ,,
35 to 40 ,, ...	4	$2\frac{1}{2}$,,	0.7 ,,	0.9 ,,
40 to 45 ,, ...	4	$2\frac{3}{4}$,,	0.7 ,,	1.0 ,,
45 to 50 ,, ...	6	3 ,,	0.8 ,,	1.1 ,,
50 to 60 ,, ...	6	$3\frac{1}{2}$,,	1.2 ,,	2.0 ,,

Rafters of ⊤ Iron.

Span of Roof.	Depth.	Sect. area of top table.	Sect. area of web.
20 to 25-feet	3 inches	0.6 inch	1.1 inch
25 to 30 ,, ...	3 ,,	0.9 ,,	1.1 ,,
30 to 35 ,, ...	3 ,,	0.9 ,,	1.1 ,,
35 to 40 ,, ...	$3\frac{3}{4}$,,	1.2 ,,	1.6 ,,
40 to 45 ,, ...	4 ,,	1.4 ,,	1.9 ,,
45 to 50 ,, ...	4 ,,	1.4 ,,	2.0 ,,
50 to 60 ,, ...	$4\frac{3}{4}$,,	1.7 ,,	2.2 ,,

Resistance of the Ends of Tie Beams, &c., to Shearing from the Thrust of the Rafter.



Let B = The breadth of the beam.

H = The horizontal thrust of rafter.

L = The length of tie beam from the end to the foot of the rafter.

For oak $L = \frac{H}{575\ B}$

For fir $L = \frac{H}{150\ B}$

This part, however, is usually secured by a wrought iron strap, which should be of a section proportionate to the thrust of the rafter.

Scarfed Joints in Tie Beams, &c.
(Tredgold).

The proportion of the length of scarf to depth of beam.

	Without Bolts.	With Bolts.	With Bolts and Indents.
Oak, ash, elm, &c.,	6 D	3 D	2 D
Fir	12 D	6 D	4 D

Water Supply and Drainage.

Provide for each man, woman, and child, 15 gallons of water per day.

For each horse 16 gallons, four of which is consumed with his food.

For each four-wheeled carriage 16 gallons, and for each two-wheeled carriage nine gallons.

If the source is rainfall, provide tankage for 120 days' supply.

Service tanks should be capable of holding three days' supply.

The available rainfall from roofs in England may be estimated at 18 inches per annum.

To determine the size of pipes for water-supply and drainage—

Let R = the hydraulic radius or mean depth

$$= \frac{\text{sectional area}}{\text{perimeter.}} = \text{in pipes } \frac{\text{diameter}}{4}$$

S = the sine of the inclination of the pipe

$$\text{or} = \frac{\text{total fall}}{\text{total length}}$$

D = Diameter of pipe in feet.
V = Velocity in feet per second.
A = Sectional area in feet.
Q = Discharge in cubic feet per second.

Neville's formula—

$$V = 140 \sqrt{RS} - 11 \sqrt[3]{RS}$$

$$Q = AV$$

$$G = 293.729\, D^2V = \text{supply in gallons per minute.}$$

Eytelwein's formula—

Open Channels, &c.

$$V = 95 \sqrt{RS}$$

$$Q = 95\, A \sqrt{RS}$$

Pipes.

$$V = 48 \sqrt{DS}$$

$$Q = 37 \sqrt{D^5 S}$$

Egg-Shaped Sewers.

$$V=50\sqrt{DS}$$

$Q=35\sqrt{D^5S}$=Discharge when flowing $\frac{2}{3}$rd full.

D being the diameter of the large circle.

The values of Q obtained from Eytelwein's formula are less than those obtained from Neville's. The latter is the most accurate for straight pipes free from obstructions, but an allowance of from $\frac{1}{3}$ to $\frac{1}{4}$ is required for curves and sudden changes of direction.

Allow for incrustation, &c., $\frac{1}{6}$th of the diameter of pipes under 3 inches, $\frac{3}{4}$ of an inch for pipes between 3 and 6 inches, and 1 inch for all diameters above 6 inches.

The loss of head in inches due to bends may be taken approximately as equal to the product of the square of the velocity in inches per second, and the sum of the squares of the sines of the angles of the bends multiplied by the constant number .0003.

In short pipes when the length does not exceed 1000 diameters, a correction will have to be made for the loss of head due to friction and to the form of the orifice at the junction of the pipe with the reservoir.

Let h=the loss of head in feet.

v=the velocity in feet per second, and which may be obtained from the tables as a first approximation.

Then

$$h=C\,v^2$$

$C = .0234$ for round orifices, such as the end of a pipe when flush with the side of the cistern.
$= .0155$ ditto when bell-mouthed.
$= .0303$ ditto when the pipe projects into the cistern.

The value of h thus obtained must be deducted from the total head before entering the table for a new velocity, which, unless the pipe is very short, will be sufficiently near for practice. Any further degree of accuracy may be attained by repeating the operation, and using the last obtained velocity in each case.

In practice it is considered that about 5 feet of head per mile is required to maintain a flow and to overcome friction in small pipes.

In SEWERS provide for removing of rainfall per hour—

From roofs	.5	inch in depth
Flagged surfaces.........	.2	,, ,,
Gravelled ,, ...	.05	,, ,,
Meadows or grass plots	.02	,, ,,
	.77	

Sewerage 5 cubic feet per head of men, women, and children, to be removed in 24 hours, one-half of which passes off in from 4 to 6 hours.

Two feet per second is the least velocity which will keep sewers clear of all ordinary obstructions. House drains and small pipes require a velocity of 3 feet per second to keep them clear.

CYLINDRICAL PIPES.—Table showing the Velocity in Feet per Second, and the Supply in Gallons per Minute, for Long Pipes flowing full, calculated from the Formula $V = 140\sqrt{R\,S} - 11\sqrt[3]{R\,S}$.

Diameter of pipe in inches.	Head of Water divided by Length of Pipe.								Diameter of pipe in inches.
	$\frac{1}{1000}$		$\frac{2}{1000}$		$\frac{3}{1000}$		$\frac{4}{1000}$		
	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	
$\frac{3}{8}$	.173	.05	.278	.08	.363	.10	.436	.13	$\frac{3}{8}$
$\frac{1}{2}$	.212	.11	.336	.17	.436	.22	.522	.27	$\frac{1}{2}$
$\frac{3}{4}$	.278	.32	.436	.50	.562	.64	.670	.77	$\frac{3}{4}$
1	.336	.69	.522	1.07	.670	1.37	.798	1.63	1
$1\frac{1}{4}$	.388	1.24	.600	1.91	.770	2.45	.911	2.90	$1\frac{1}{4}$
$1\frac{1}{2}$	.436	2.00	.670	3.08	.856	3.93	1.02	4.67	$1\frac{1}{2}$
$1\frac{3}{4}$	.481	3.00	.736	4.60	.938	5.86	1.11	6.94	$1\frac{3}{4}$
2	.522	4.26	.798	6.51	1.02	8.29	1.20	9.81	2
$2\frac{1}{2}$	.600	7.64	.911	11.62	1.16	14.76	1.37	17.45	$2\frac{1}{2}$
3	.670	12.30	1.02	18.66	1.29	23.64	1.52	27.92	3
4	.798	26.03	1.20	39.23	1.52	49.63	1.79	58.53	4
5	.911	46.48	1.37	69.79	1.73	88.14	2.04	103.84	5
6	1.02	74.64	1.52	111.66	1.92	140.83	2.26	165.77	6
7	1.11	111.09	1.66	166.07	2.09	209.22	2.46	246.10	7
8	1,20	156.92	1.79	234.11	2.26	294.70	2.65	346.45	8
9	1.29	212.71	1.92	316.87	2.41	398.58	2.83	468.35	9
10	1.37	279.16	2.04	415.34	2.56	522.08	3.01	613 22	10
11	1.45	356.95	2.15	530.42	2.70	666.39	3.17	782.42	11
12	1.52	446.66	2.26	663.07	2.83	832.63	3.33	977.29	12
15	1.73	793.27	2.56	1174.7	3.21	1473.2	3.76	1727.8	15
18	1.92	1267.5	2.83	1873.4	3.55	2347.2	4.16	2751.4	18
24	2.26	2652.2	3.33	3909.2	4.16	4891.4	4.88	5727.8	24
30	2.56	4698.8	3.76	6911.3	4.71	8638.9	5.51	10109.7	30

Cylindrical Pipes—continued.

Diameter of pipe in inches.	Head of Water divided by Length of Pipe.								Diameter of pipe in inches.
	$\frac{5}{1000}$		$\frac{6}{1000}$		$\frac{7}{1000}$		$\frac{8}{1000}$		
	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	
$\frac{3}{8}$	.502	.14	.5[illegible]2	.16	.618	.18	.670	.19	$\frac{3}{8}$
$\frac{1}{2}$	.600	.31	.670	.34	.736	.38	.798	.41	$\frac{1}{2}$
$\frac{3}{4}$	.770	.88	.856	.98	.938	1.08	1.02	1.17	$\frac{3}{4}$
1	.911	1.86	1.02	2.08	1.11	2.27	1.20	2.45	1
$1\frac{1}{4}$	1.04	3.31	1.16	3.69	1.27	4.04	1.37	4.36	$1\frac{1}{4}$
$1\frac{1}{2}$	1.16	5.44	1.29	5.91	1.41	6.46	1.52	6.98	$1\frac{1}{2}$
$1\frac{3}{4}$	1.27	7.91	1.41	8.79	1.55	9.68	1.66	10.38	$1\frac{3}{4}$
2	1.37	11.17	1.52	12.41	1.66	13.56	1.79	14.63	2
$2\frac{1}{2}$	1.56	19.85	1.73	22.04	1.82	23.30	2.04	25.96	$2\frac{1}{2}$
3	1.73	31.73	1.92	35.21	2.09	38.43	2.26	41.44	3
4	2.04	66.46	2.26	73.68	2.46	80.36	2.65	86.61	4
5	2.31	117.80	2.56	130.52	2.79	142.30	3.01	153.31	5
6	2.56	187.95	2.83	208.16	3.09	226.84	3.33	244.32	6
7	2.79	278.90	3.09	308.76	3.37	335.60	3.62	362.21	7
8	3.01	392.46	3.33	434.35	3.62	473.09	3.90	509.38	8
9	3.21	530.36	3.55	586.82	3.87	639.02	4.16	687.85	9
10	3.40	694.24	3.76	767.92	4.09	833.58	4.41	899.75	10
11	3.59	885.56	3.97	979.39	4.32	1066.1	4.65	1147.2	11
12	3.76	1105.8	4.16	1222.9	4.53	1331.8	4.88	1432.0	12
15	4.26	1956.7	4.71	2159.7	5.12	2349.8	5.51	2527.4	15
18	4.71	3110.0	5.18	3426.1	5.65	3737.0	6.08	4019.3	18
24	5.51	6470.3	6.08	7145.4	6.61	7769.1	7.11	8351.6	24
30	6.22	11415.0	6.86	12601.3	7.50	13772.4	8.02	14720.4	30

CYLINDRICAL PIPES—*continued.*

Diameter of pipe in inches.	Head of Water divided by Length of Pipe. $\frac{9}{1000}$ Velocity in feet per second.	$\frac{9}{1000}$ Supply in gallons per minute.	$\frac{1}{100}$ Velocity in feet per second.	$\frac{1}{100}$ Supply in gallons per minute.	$\frac{2}{100}$ Velocity in feet per second.	$\frac{2}{100}$ Supply in gallons per minute.	$\frac{3}{100}$ Velocity in feet per second.	$\frac{3}{100}$ Supply in gallons per minute.	Diameter of pipe in inches.
$\frac{3}{8}$	.720	.21	.770	.22	1.16	.33	1.47	.42	$\frac{3}{8}$
$\frac{1}{2}$	.856	.44	.911	.46	1.37	.70	1.73	.88	$\frac{1}{2}$
$\frac{3}{4}$	1.09	1.24	1.16	1.33	1.73	1.98	2.18	2.50	$\frac{3}{4}$
1	1.29	2.63	1.37	2.79	2.04	4.15	2.56	5.22	1
$1\frac{1}{4}$	1.47	4.67	1.56	4.96	2.31	7.36	2.90	9.24	$1\frac{1}{4}$
$1\frac{1}{2}$	1.63	7.47	1.73	7.93	2.56	11.75	3.21	14.73	$1\frac{1}{2}$
$1\frac{3}{4}$	1.78	11.10	1.89	11.79	2.79	17.43	3.50	21.84	$1\frac{3}{4}$
2	1.92	15.65	2.04	16.61	3.01	24.53	3.76	30.72	2
$2\frac{1}{2}$	2.18	27.75	2.31	29.45	3.40	43.39	4.26	54.35	$2\frac{1}{2}$
3	2.41	44.29	2.56	46.99	3.76	69.11	4.71	86.39	3
4	2.83	92.51	3.01	98.60	4.41	144.20	5.51	179.73	4
5	3.21	163.69	3.40	173.70	4.99	254.50	6.22	317.08	5
6	3.55	260.81	3.76	277.10	5.51	404.30	6.86	504.05	6
7	3.87	386.57	4.09	408.45	5.99	598.62	7.50	749.83	7
8	4.16	543.49	4.41	575.83	6.44	840.68	8.02	1046.8	8
9	4.44	733.83	4.71	777.50	6.86	1134.1	8.54	1411.6	9
10	4.71	959.88	4,99	1016.9	7.27	1482.3	9.04	1844.3	10
11	4.96	1223.7	5.26	1298.4	7.65	1888.3	9.52	2348.8	11
12	5.18	1522.7	5 51	1617.6	8.02	2355·3	9.97	2928.7	12
15	5.87	2694.9	6.22	2853.8	9.04	4149.7	11.24	5157.0	15
18	6.48	4284.7	6.86	4536.5	10.07	6653.8	12.38	8184.8	18
24	7.58	8900.4	8.02	9421.1	11.63	13664.4	14.43	16958.3	24
30	8.54	15684.5	9.04	16599.0	13.10	23993.0	16.25	29828.1	30

CYLINDRICAL PIPES—*continued.*

Diameter of pipe in inches.	Head of Water divided by Length of Pipe.								Diameter of pipe in inches.
	$\frac{4}{100}$		$\frac{5}{100}$		$\frac{6}{100}$		$\frac{7}{100}$		
	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	
$\frac{3}{8}$	1.73	.50	1.96	.56	2.18	.62	2.37	.68	$\frac{3}{8}$
$\frac{1}{2}$	2.04	1.04	2.31	1.18	2.56	1.31	2.79	1.42	$\frac{1}{2}$
$\frac{3}{4}$	2.56	2.94	2.90	3.33	3.21	3.68	3.50	4.01	$\frac{3}{4}$
1	3.01	6.13	3.40	6.94	3.76	7.68	4.09	8.34	1
$1\frac{1}{4}$	3.40	10.85	3.85	12.27	4.26	13.59	4.63	14.77	$1\frac{1}{4}$
$1\frac{1}{2}$	3.76	17.28	4.26	19.57	4.71	21.60	5.12	23.50	$1\frac{1}{2}$
$1\frac{3}{4}$	4.09	25.53	4.63	28.95	5.12	31.98	5.57	34.79	$1\frac{3}{4}$
2	4.41	35.99	4.99	40.67	5.51	44.93	5.99	48.87	2
$2\frac{1}{2}$	4.99	63.55	5.63	71.79	6.22	79.27	6.76	86.18	$2\frac{1}{2}$
3	5.51	101.10	6.22	114.15	6.86	126.01	7.50	137.72	3
4	6.44	210.17	7.27	237.17	8.02	261.70	8.71	284.34	4
5	7.27	370.57	8.20	418.02	9.04	461.08	9.82	500.86	5
6	8.02	588.82	9.04	663.96	9.97	732.18	10.83	795.20	6
7	8.71	870.78	9.82	981.68	10.83	1082.4	11.76	1175.3	7
8	9.36	1222.0	10.55	1377.3	11.63	1518.3	12.63	1648.4	8
9	9.97	1647.4	11.24	1856.4	12.38	2046.2	13.44	2221.3	9
10	10.55	2152.0	11.89	2424.5	13.10	2665.9	14.22	2900.4	10
11	11.10	2740.1	12.49	3082.9	13.78	3401.4	14.96	3691.7	11
12	11.63	3416.1	13.10	3838.9	14.43	4239.6	15.66	4601.1	12
15	13.10	5998.2	14.75	6769.5	16.25	7457.0	17.63	8091.3	15
18	14.43	9539.1	16.25	10738.1	17.89	11826.3	19.41	12830.1	18
24	16.81	19751.1	18.92	22228.8	20.83	24474.3	22.59	26545.4	24
30	18.92	34732.5	21.28	39073.2	23.43	43011.1	25.41	46642.4	30

CYLINDRICAL PIPES—*continued.*

Diameter of pipe in inches.	Head of Water divided by Length of Pipe.								Diameter of pipe in inches.
	$\frac{8}{100}$		$\frac{9}{100}$		$\frac{1}{10}$		$\frac{2}{10}$		
	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	
$\frac{3}{8}$	2.56	.73	2.74	.79	2.90	.83	4.26	1.22	$\frac{3}{8}$
$\frac{1}{2}$	3.01	1.53	3.21	1.64	3.40	1.36	4.99	2.54	$\frac{1}{2}$
$\frac{3}{4}$	3.76	4.32	4.01	4.60	4.26	4.89	6.22	7.13	$\frac{3}{4}$
1	4.41	9.00	4.71	9.60	4.99	10.17	7.27	14.82	1
$1\frac{1}{4}$	4.99	15.89	5.32	16.94	5.63	17.95	8.20	26.13	$1\frac{1}{4}$
$1\frac{1}{2}$	5.51	25.27	5.87	26.95	6.22	28.54	9.04	41.50	$1\frac{1}{2}$
$1\frac{3}{4}$	5.99	37.41	6.38	39.89	6.76	42.23	9.82	61.35	$1\frac{3}{4}$
2	6.44	52.54	6.86	56.01	7.27	59.29	10.55	86.08	2
$2\frac{1}{2}$	7.27	92.64	7.74	98.70	8.20	104.50	11.89	151.53	$2\frac{1}{2}$
3	8.02	147.20	8.54	156.85	9.04	165.99	13.10	239.93	3
4	9.36	305.50	9.97	325.41	10.55	344.32	15.26	498.17	4
5	10.55	537.99	11.24	572.99	11.89	606.13	17.18	876.11	5
6	11.63	854.02	12.38	909.42	13.10	959.72	18.92	1389.3	6
7	12.63	1262.1	13.44	1343.7	14.22	1421,2	20.52	2051.3	7
8	13.56	1765.8	14.43	1884.3	15.26	1992.7	22.02	2874.7	8
9	14.43	2384.8	15.36	2538.6	16.25	2684.5	23.43	3871.0	9
10	15.26	3113.5	16.25	3314.2	17.18	3504.5	24.76	5051.3	10
11	16.06	3962.7	17.09	4217.9	18.07	4459.7	26.04	6425.9	11
12	16.81	4938.6	17.89	5256.2	18.92	5557.2	27.25	8004.7	12
15	18.92	8683.1	20.13	9240.3	21.28	9768.3	30.63	14059.7	15
18	20.83	13766.8	22.16	14648.5	23.43	15484.0	33.70	22273.1	18
24	24.24	28477.6	25.79	30296.3	27.25	32018.8	39.17	46016.9	24
30	27.25	50029.4	28.99	53218.5	30.63	56238.9	44.0	80770.7	30

CYLINDRICAL PIPES—*continued.*

Diameter of pipe in inches.	Head of Water divided by Length of Pipe.								Diameter of pipe in inches.
	3/10		4/10		5/10		6/10		
	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	
$\frac{3}{8}$	5.32	1.52	6.22	1.78	7.02	2.01	7.74	2.22	$\frac{3}{8}$
$\frac{1}{2}$	6.22	3.17	7.27	3.71	8.20	4.18	9.04	4.61	$\frac{1}{2}$
$\frac{3}{4}$	7.74	8.89	9.04	10.37	10.19	11.69	11.24	12.89	$\frac{3}{4}$
1	9.04	18.44	10.55	21.52	11.89	24.25	13.10	26.66	1
$1\frac{1}{4}$	10.19	32.48	11.89	37.88	13.39	42.67	14.75	47.01	$1\frac{1}{4}$
$1\frac{1}{2}$	11.24	51.57	13.10	59.98	14.75	67.70	16.25	74.57	$1\frac{1}{2}$
$1\frac{3}{4}$	12.20	76.21	14.22	88.82	16.01	99.99	17.63	110.14	$1\frac{3}{4}$
2	13.10	106.64	15.26	124.54	17.18	140.18	18.92	154.37	2
$2\frac{1}{2}$	14.75	188.42	17.18	219.03	19.33	246.46	21.28	271.34	$2\frac{1}{2}$
3	16.25	298.28	18.92	347.32	21.28	390.73	23.43	430.11	3
4	18.92	617.47	22.02	718.66	24.76	808.21	25.25	824.14	4
5	21.28	1085.4	24.76	1262.8	27.84	1419.8	30.63	1561.7	5
6	23.43	1720.4	27.25	2001.2	30.63	2248.9	33.70	2474.8	6
7	25.41	2539.4	29.55	2953.2	33.21	3319.2	36.53	3651.1	7
8	27.25	3557.6	31.67	4134.9	35.60	4647.9	39.17	5113.0	8
9	28.99	4789.7	33.70	5568.3	37.87	6256.8	41.65	6881.1	9
10	30.63	6246.9	35.60	7262.3	40.01	8161.0	44.00	8974.3	10
11	32.20	7947.9	37.41	9234.4	42.00	10365.4	46.24	11411.6	11
12	33.70	9899.2	39.17	11504.2	44.00	12923.0	48.38	14209.8	12
15	37.87	17380.0	44.00	20192.7	49.42	22679.2	54.33	24932.9	15
18	41.65	27524.2	48.38	31972.0	54.33	35903.4	59.72	39465.9	18
24	48.38	56839.1	56.18	66005.2	63.07	74102.4	69.32	81442.6	24
30	54.33	99731.6	63.07	115785.	70.80	129971.	77.80	142825.	30

CYLINDRICAL PIPES--*continued.*

Diameter of pipe in inches.	Head of Water divided by Length of Pipe.								Diameter of pipe in inches.
	$\frac{7}{10}$		$\frac{8}{10}$		$\frac{9}{10}$		$\frac{1}{1}$		
	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	Velocity in feet per second.	Supply in gallons per minute.	
$\frac{3}{8}$	8.42	2.41	9.04	2.59	9.63	2.76	10.19	2.92	$\frac{3}{8}$
$\frac{1}{2}$	9.82	5.01	10.55	5.38	11.24	5.73	11.89	6.06	$\frac{1}{2}$
$\frac{3}{4}$	12.20	14.00	13.10	15.00	13.93	15.98	14.75	16.92	$\frac{3}{4}$
1	14.22	29.00	15.26	31.14	16.25	33.14	17.18	35.04	1
$1\frac{1}{4}$	16.01	51.02	17.18	54.76	18.28	58.28	19.33	61.61	$1\frac{1}{4}$
$1\frac{1}{2}$	17.63	80.91	18.92	86.83	20.13	92.40	21.28	97.68	$1\frac{1}{2}$
$1\frac{3}{4}$	19.13	119.48	20.52	128.21	21.84	136.42	23.08	144.20	$1\frac{3}{4}$
2	20.52	167.45	22.02	179.67	23.43	191.16	24.76	202.05	2
$2\frac{1}{2}$	23.08	294.29	24.76	315.71	26.34	335.86	27.84	354.95	$2\frac{1}{2}$
3	25.41	466.42	27.25	500.29	28.99	532.18	30.63	562.22	3
4	29.55	964.31	31.67	1033.7	33.70	1099.9	35.60	1162.0	4
5	33.21	1692.6	35.60	1815.6	37.87	1931.1	40.01	2040.2	5
6	36.53	2682.4	39.17	2876.1	41.65	3058.2	44 00	3230.8	6
7	39.59	3957.0	42.44	4242.3	45.13	4510.7	47.67	4764.9	7
8	42.44	5540.9	45.50	5940.0	48.38	6315.4	51.10	6671.1	8
9	45.13	7456.4	48.38	7993.0	51.44	8499.2	54.33	8975.8	9
10	47.67	9724.4	51.10	10423.5	54.33	11081.3	57.38	11704.2	10
11	50.10	12364.4	53.70	13252.8	57.08	14088.5	60.29	14880.0	11
12	52.40	15391.1	56.18	16501.3	59.72	17540.4	63.07	18525.6	12
15	58.85	27009.8	63.07	28946.2	67.04	30767.7	70.80	32492.7	15
18	64.52	42641.5	69.32	45811.5	73.67	48690.4	77.80	51416.9	18
24	75.07	88204.4	80.44	94508.9	85.49	100438.1	90.26	106052.8	24
30	84.25	154368.	90.26	165708.	95.92	176090.	101.26	185902.	30

CYLINDRICAL SEWERS.—Table showing the velocity in feet per second, and the discharge in cubic feet per minute, when flowing one-half full. Calculated from the formula

$$V = 140 \sqrt{R\,S} - 11 \sqrt[3]{R\,S}$$

Diameter in inches.	Fall divided by Length of Pipe.								Diameter in inches.
	$\frac{1}{10000}$		$\frac{2}{10000}$		$\frac{3}{10000}$		$\frac{4}{10000}$		
	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	
2	.109	.071	.185	.121	.240	.157	.291	.191	2
3	.147	.217	.240	.353	.315	.464	.378	.557	3
4	.185	.484	.291	.762	.378	.990	.455	1.19	4
6	.240	1.41	.378	2.23	.490	2.89	.585	3.45	6
9	.315	4.18	.490	6.49	.620	8.22	.749	9.93	9
12	.378	8.91	.585	13.78	.749	17.65	.889	20.95	12
15	.436	16.05	.670	24.67	.856	31.51	1.019	37.16	15
18	.490	25.98	.749	39.71	.954	50.58	1.130	59.91	18
21	.538	38.82	.820	59.17	1.043	75.26	1.237	89.26	21
24	.585	55.14	.889	83.79	1.130	106.5	1.337	126.0	24
30	.670	98.67	1.019	150.1	1.287	189.5	1.521	224.0	30
36	.749	158.8	1.130	239.6	1.440	305.4	1.700	360.5	36

CYLINDRICAL SEWERS—*continued.*

Diameter in inches.	Fall divided by Length of Pipe. $\frac{5}{10000}$		$\frac{6}{10000}$		$\frac{7}{10000}$		$\frac{8}{10000}$		Diameter in inches.
	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Dischaıge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	
2	.336	.220	.378	.247	.417	.273	.455	.298	2
3	.436	.642	.490	.722	.537	.791	.585	.862	3
4	.522	1.37	.585	1.53	.640	1.68	.697	..83	4
6	.670	3.95	.749	4.41	.823	4.82	.889	5.24	6
9	.856	11.35	.954	12.64	1.043	13.82	1.130	14.98	9
12	1.019	24.02	1.130	26.63	1.237	29.15	1.337	31.50	12
15	1.158	42.63	1.287	47.38	1.408	51.84	1.520	55.96	15
18	1.287	68.23	1.440	76.34	1.564	82.92	1.700	90.13	18
21	1.408	101.6	1.564	112.9	1.709	123.3	1.845	133.1	21
24	1.521	143.4	1.700	160.2	1.845	173.9	1.989	187.5	24
30	1.728	254.5	1.918	282.5	2.093	308.2	2.257	332.4	30
36	1.918	406.7	2.127	451.0	2.320	490.8	2.502	530.6	36

CYLINDRICAL SEWERS—*continued.*

Diameter in inches.	Fall divided by Length of Pipe.								Diameter in inches.
	$\frac{9}{10000}$		$\frac{1}{1000}$		$\frac{2}{1000}$		$\frac{3}{1000}$		
	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	
2	.490	.321	.522	.342	.798	.522	1.019	.667	2
3	.620	.913	.670	.987	1.019	1.50	1.287	1.90	3
4	.749	1.96	.798	2.09	1.202	3.15	1.521	3.98	4
6	.954	5.62	1.019	6.00	1.521	8.96	1.918	11.30	6
9	1.211	16.05	1.287	17.06	1.918	25.42	2.412	31.97	9
12	1.440	33.93	1.521	35.84	2.257	53.18	2.835	66.80	12
15	1.627	59.90	1.728	63.62	2.560	94.25	3.210	118.2	15
18	1.806	95.75	1.918	101.6	2.835	150.3	3.552	188.3	18
21	1.972	142.3	2.093	151.0	3.093	223.2	3.868	279.1	21
24	2.127	200.5	2.257	212.7	3.327	313.6	4.163	392.4	24
30	2.412	355.2	2.560	377.0	3.765	554.4	4.706	693.0	30
36	2.672	566.6	2.835	601.2	4.163	882.8	5.184	1099.3	36

CYLINDRICAL SEWERS—*continued.*

Diameter in inches.	Fall divided by Length of Pipe. 4/1000 Velocity in feet per second.	4/1000 Discharge in cubic feet per minute.	5/1000 Velocity in feet per second.	5/1000 Discharge in cubic feet per minute.	6/1000 Velocity in feet per second.	6/1000 Discharge in cubic feet per minute.	7/1000 Velocity in feet per second.	7/1000 Discharge in cubic feet per minute.	Diameter in inches.
2	1.202	.787	1.369	.896	1.521	.996	1.662	1.09	2
3	1.521	2.24	1.728	2.55	1.918	2.82	2.093	3.08	3
4	1.793	4.69	2.036	5.33	2.257	5.91	2.462	6.45	4
6	2.257	13.30	2.560	15.08	2.835	16.70	3.089	18.20	6
9	2.835	37.57	3.210	42.54	3.552	47.08	3.868	51.27	9
12	3.327	78.39	3.765	88.71	4.163	98.09	4.534	106.8	12
15	3.765	138.6	4.263	156.9	4.706	173.3	5.120	188.5	15
18	4.163	220.7	4.706	249.5	5.184	274.8	5.654	299.7	18
21	4.531	327.0	5.120	369.5	5.655	408.1	6.150	443.8	21
24	4.875	459.5	5.507	519.0	6.082	573.2	6.612	623.2	24
30	5.507	811.0	6.218	915.7	6.864	1010.8	7.502	1104.8	30
36	6.082	1289.7	6.864	1455.6	7.575	1606.3	8.232	1745.7	36

CYLINDRICAL SEWERS—*continued*.

Diameter in inches.	Fall divided by Length of Pipe.								Diameter in inches.
	$\frac{8}{1000}$		$\frac{9}{1000}$		$\frac{1}{100}$		$\frac{2}{100}$		
	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	
2	1.793	1.17	1.918	1.26	2.036	1.33	3.006	1.97	2
3	2.257	3.32	2.412	3.55	2.560	3.77	3.765	5.54	3
4	2.654	6.95	2.835	7.42	3.006	7.87	4.411	11.55	4
6	3.327	19.60	3.552	20.92	3.765	22.18	5.507	32.44	6
9	4.163	55.18	4.441	58.86	4.706	62.37	6.864	90.97	9
12	4.875	114.9	5.185	122.2	5.507	129.8	8.019	188.9	12
15	5.507	202.7	5.872	216.2	6.218	228.9	9.042	332.9	15
18	6.082	322.4	6.483	343.7	6.864	363.9	10.068	533.8	18
21	6.612	477.1	7.048	508.6	7.502	541.3	10.829	781.4	21
24	7.108	669.9	7.575	713.9	8.019	755.8	11.630	1096.1	24
30	8.019	1180.9	8.544	1258.2	9.042	1331.6	13.100	1929.1	30
36	8.845	1875.7	9.423	1998.2	9.971	2114.4	14.434	3060.9	36

Cylindrical Sewers—*continued.*

Diameter in inches.	Fall divided by Length of Pipe.								Diameter in inches.
	$\frac{3}{100}$		$\frac{4}{100}$		$\frac{5}{100}$		$\frac{6}{100}$		
	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	
2	3.765	2.46	4.411	2.89	4.985	3.26	5.507	3.60	2
3	4.706	6.93	5.507	8.11	6.218	9.14	6.864	10.10	3
4	5.507	14.42	6.440	16.86	7.267	19.03	8.019	20.99	4
6	6.864	40.43	8.019	47.24	9.042	53.26	9.971	58.74	6
9	8.544	113.2	9.971	132.2	11.236	148.9	12.384	164.1	9
12	9.971	234.9	11.630	274.0	13.100	308.7	14.434	340.1	12
15	11.236	413.7	13.100	482.3	14.750	543.0	16.248	598.2	15
18	12.384	656.5	14.437	765.4	16.248	861.4	17.895	948.7	18
21	13.444	970.1	15.664	1130.3	17.630	1272.2	19.413	1400.8	21
24	14.437	1360.7	16.813	1584.6	18.919	1783.1	20.831	1963.3	24
30	16.248	2392.7	18.919	2786.0	21.284	3134.2	23.429	3450.2	30
36	17.895	3794.8	20.831	4417.4	23.429	4968.3	25.786	5468.1	36

CYLINDRICAL SEWERS—*continued.*

Diameter in inches.	Fall divided by Length of Pipe.								Diameter in inches.
	$\frac{7}{100}$		$\frac{8}{100}$		$\frac{9}{100}$		$\frac{1}{10}$		
	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.	
2	5.989	3.92	6.440	4.22	6.864	4.49	7.267	4.76	2
3	7.502	11.05	8.019	11.81	8.544	12.58	9.042	13.32	3
4	8.712	22.81	9.361	24.51	9.971	26.10	10.550	27.62	4
6	10.829	63.79	11.630	68.51	12.384	72.95	13.100	77.17	6
9	13.444	178.2	14.434	191.3	15.365	203.6	16.248	215.3	9
12	15.664	369.1	16.813	396.1	17.895	421.6	18.919	445.8	12
15	17.630	649.1	18.919	696.5	20.133	741.2	21.284	783.5	15
18	19.413	1029.2	20.831	1104.3	22.165	1175.1	23.429	1242.1	18
21	21.103	1522.8	22.584	1629.6	24.038	1734.6	25.407	1833.3	21
24	22.593	2129.3	24.238	2284.4	25.786	2430.3	27.252	2568.5	24
30	25.407	3741.5	27.252	4013.2	28.989	4269.0	30.634	4511.2	30
36	27.959	5928.9	29.986	6358.8	31.894	6763.4	33.702	7146.8	36

For EGG-SHAPED SEWERS, the diameter of whose large circle equals that of the Cylindrical Sewer; when flowing *one-half* full take $1\frac{1}{2}$, and when flowing *two-thirds* full take 2 of the above,

E

The Pressure of Water against Walls, Sides of Cisterns, &c.

A = Area of surface pressed in feet.
H = Depth of centre of gravity below surface in ft.
Then

$$\text{Pressure in lbs.} = 62\tfrac{1}{2}\ A\ H.$$

The pressure may be considered as acting at a point $\frac{2}{3}$rds of the total depth from the top.

The Discharge of Water through Orifices, Sluices, &c.

A = Area of orifice, &c., in feet.
H = Depth of water from surface to centre of orifice in feet.
Q = Quantity discharged in cubic feet per second.
V = Velocity in feet per second.

$$V = C\sqrt{H}.$$
$$Q = AV.$$

$C = 4.98$ for all orifices in thin plates.
$= 6.00$ „ short tubes.
$= 5.00$ „ sluices without side walls, &c.
$= 7.00$ „ ditto with side walls, and for wide openings whose bottom is level with that of the reservoir.
$= 6.50$ " narrow openings.

Gas Supply.

Let D = Diameter of pipe in inches.
G = Specific gravity of gas.
L = Length of pipe in yards.
P = Pressure in inches by the water gauge.
Q = Quantity of gas supplied in cubic feet per hour.

$$D = C\sqrt[5]{\left(\frac{G\,L\,Q^2}{P}\right)}$$

$$Q = M\sqrt{\left(\frac{D^5\,P}{G\,L}\right)}$$

Value of C for service pipes = .073.
" main pipes = .063.
Value of M for service pipes = 780.
" main pipes = 1000.

To find the diminished pressure $=p$ at the end of the main pipe when there are no branches supplied from it.

$$p = P - .55\,\frac{G\,L\,Q^2}{D^5}$$

The value of G ranges from .4 to .5; atmospheric air being 1. In general it may be assumed at .45.

P is reduced by friction and leakage from about 25 *tenths* of an inch at the works to about 3 *tenths* at the burner, according to distance. It also varies at the rate of about $\frac{1}{100}$ of an inch for every foot of rise or fall in the inclination of the pipe.

To regulate the pressure in the higher levels, governors are usually placed at every 30 feet of elevation, and syphons at every depression to receive the water which drains from the pipe.

Allow 4 cubic feet of gas per hour for internal lights and 5 cubic feet for external lights. When large or Argand burners are used allow from 6 to 10 cubic feet per hour.

Gas Service Pipes.

Supply in Cubic Feet per Hour.

Pressure = $\frac{1}{10}$ inch.

Length of Pipe in yards.	Diameter of Pipe in inches.					
	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$
5	12.7	26.0	75.2	147.6	257.8	406.7
10	9.0	18.4	50.8	104.3	182.3	287.6
20	6.3	13.0	35.9	73.8	128.9	203.3
30	5.1	10.6	29.3	60.2	105.2	166.0
40	4.5	9.2	25.4	52.2	92.1	143.8
50	4.0	8.2	22.7	46.7	81.5	128.6

Pressure = $\frac{2}{10}$ inch.

5	18.0	36.9	101.7	208.7	364.6	575.1
10	12.7	26.1	71.9	147.6	257.8	406.7
20	9.0	18.5	50.8	104.0	182.3	287.6
30	7.4	15.1	41.5	85.2	148.8	234.8
40	6.4	13.0	35.9	73.8	128.9	203.3
50	5.7	11.7	32.2	66.0	115.3	181.9

Pressure = $\frac{3}{10}$ inch.

5	22.0	45.2	124.5	255.6	446.5	704.3
10	15.6	32.0	88.0	180.7	315.7	498.1
20	11.0	22.6	62.3	127.8	223.3	352.2
30	9.0	18.4	50.8	104.3	182.3	287.6
40	7.8	16.0	44.0	90.4	157.9	249.0
50	7.0	14.3	39.4	80.8	141.2	222.5

Gas Service Pipes—*continued.*

Pressure = $\frac{4}{10}$ inch.

Length of Pipe in yards.	Diameter of Pipe in inches.					
	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$
5	25.5	52.2	143.8	295.1	515.6	813.3
10	18.0	36.9	101.7	208.7	364.6	575.1
20	12.7	26.1	71.9	147.6	257.8	406.7
30	10.4	21.3	58.7	120.5	210.5	332.0
40	9.0	18.5	50.8	104.0	182.3	287.6
50	8.0	16.5	45.5	93.3	163.0	257.2

Pressure = $\frac{5}{10}$ inch.

5	28.4	58.3	160.7	337.0	576.5	909.3
10	20.1	41.3	113.7	233.3	407.6	643.0
20	14.2	29.2	80.4	165.0	288.2	454.7
30	11.6	23.8	65.6	134.7	235.3	371.2
40	10.0	20.6	56.8	116.7	203.8	321.5
50	9.0	18.5	50.8	104.3	182.3	287.6

Pressure = $\frac{6}{10}$ inch.

5	31.1	63.9	176.1	361.5	631.5	996.1
10	22.1	45.2	124.5	255.6	446.5	704.3
20	15.6	32.0	88.0	180.7	315.7	498.1
30	12.7	26.1	71.9	147.6	257.8	406.7
40	11.0	22.6	62.3	127.8	223.3	351.2
50	9.8	20.2	55.7	114.3	199.7	315.0

Gas Service Pipes—*continued.*

Pressure $= \frac{7}{10}$ inch.

Length of Pipe in yards.	Diameter of Pipe in inches.					
	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$
5	33.6	69.0	190.2	390.4	682.1	1076.0
10	23.8	49.0	134.4	275.8	482.3	757.4
20	16.8	34.5	95.1	195.2	341.0	538.0
30	13.7	28.2	77.7	159.4	278.5	439.3
40	11.9	24.4	67.3	138.0	241.2	380.4
50	10.6	21.8	60.1	123.5	215.7	340.2
Pressure $= \frac{8}{10}$ inch.						
5	35.9	73.8	203.3	417.4	729.2	1150.2
10	25.5	52.2	143.8	295.1	515.6	813.3
20	18.0	36.9	101.7	208.7	364.6	575.1
30	14.7	30.1	83.0	170.4	297.7	469.6
40	12.7	26.1	71.9	147.6	257.8	406.7
50	11.4	23.3	64.3	132.0	229.7	363.7
Pressure $= \frac{9}{10}$ inch.						
5	38.1	78.3	215.7	442.8	773.4	1220.0
10	27.0	55.3	151.6	312.9	546.7	862.4
20	19.0	39.1	107.8	221.3	386.7	610.0
30	15.5	31.9	88.1	180.7	315.7	498.1
40	13.4	27.7	76.2	157.5	273.4	431.3
50	12.1	24.7	68.3	140.0	244.9	385.8

Gas Service Pipes—*continued.*

Pressure = 1 inch.

Length of Pipe in yards.	Diameter of Pipe in inches.					
	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$
5	40.2	82.5	227.3	466.7	815.2	1286.0
10	28.4	58.3	160.7	337.0	576.5	909.3
20	20.1	41.3	113.7	233.3	407.6	643.0
30	16.4	33.7	92.8	190.5	332.8	525.0
40	14.2	29.2	80.4	165.0	288.2	454.7
50	12.7	26.1	71.9	147.6	257.8	406.7

Pressure = $1\frac{1}{4}$ inch.

5	44.5	91.9	253.3	520.0	908.4	1432.9
10	31.8	65.0	179.1	367.7	642.3	1012.3
20	22.5	46.0	126.7	260.0	454.2	716.5
30	18.3	37.5	103.4	212.3	370.9	585.0
40	15.8	32.5	89.6	183.8	321.2	506.6
50	14.2	29.1	80.1	164.4	287.3	453.1

Gas Mains.—Supply in Cubic Feet per Hour.

Pressure = 1 inch.

Length of Pipe in yards.	Diameter of Pipe in inches.									
	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	9	12
100	843	1473	2323	3416	4770	6404	8333	13145	36224	74361
250	533	932	1470	2161	3017	4050	5270	8314	22910	47030
500	377	659	1039	1528	2133	2864	3727	5879	16200	33255
1,000	267	466	735	1080	1509	2025	2635	4157	11455	23515
5,000	119	208	329	483	675	906	1179	1859	5123	10516
10,000	84	147	232	342	477	640	833	1315	3623	74361

Pressure = $1\frac{1}{4}$ inch.

Length of Pipe in yards.	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	9	12
100	943	1647	2598	3820	5333	7159	9317	14697	40500	83139
250	596	1042	1643	2416	3373	4528	5893	9295	25614	52581
500	422	737	1162	1708	2385	3202	4167	6573	18112	37181
1,000	298	521	822	1208	1687	2264	2946	4648	12807	26291
5,000	133	233	367	540	755	1013	1318	2079	5728	11758
10,000	94	165	260	382	533	716	932	1470	4050	8314

Gas Mains—*continued.*

Pressure = $1\frac{1}{2}$ inch.

Length of Pipe in yards.	Diameter of Pipe in inches.									
	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	9	12
100	1033	1804	2846	4184	5842	7843	10206	16100	44366	91074
250	653	1141	1800	2646	3695	6245	6455	10182	28059	57600
500	462	807	1273	1871	2613	3507	4564	7200	19841	40729
1000	327	571	900	1323	1847	3122	3227	5091	14030	28800
5000	146	255	402	470	826	1109	1443	2277	6274	12880
10000	103	180	285	418	584	784	1021	1610	4437	9107
					Pressure = $1\frac{3}{4}$ inch.					
100	1116	1949	3074	4519	6311	8471	11024	17389	47920	98371
250	706	1233	1944	2858	3991	5358	6972	10998	30307	62215
500	499	872	1375	2021	2822	3788	4930	7777	21431	43993
1000	353	616	972	1429	1996	2679	3486	5499	15154	31108
5000	158	276	435	639	893	1198	1559	2459	6777	13912
10000	112	195	307	452	631	847	1102	1739	4792	9837

Gas Mains—*continued.*

Pressure $= 2$ inches.

Length of Pipe in yards.	Diameter of Pipe in inches.									
	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	9	12
100	1193	2083	3286	4831	6746	9056	11785	18590	51229	105162
250	754	1318	2078	3056	4267	5728	7454	11758	32400	66511
500	533	932	1470	2161	3017	4050	5270	8314	22910	47030
1000	377	659	1039	1528	2133	2864	3727	5879	16200	33255
5000	169	295	465	683	955	1281	1667	2629	7245	14872
10000	119	208	329	483	675	906	1179	1859	5123	10516

Pressure $= 2\frac{1}{2}$ inches.

Length of Pipe in yards.	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	9	12
100	1333	2329	3674	5402	7542	10125	13176	20785	57276	117575
250	843	1473	2324	3416	4770	6404	8333	13145	36224	74361
500	596	1042	1643	2416	3373	4528	5893	9295	25614	52581
1000	422	737	1162	1708	2385	3202	4167	6573	18112	37181
5000	189	329	520	764	1067	1432	1863	2939	8100	16628
10000	133	233	367	540	754	1013	1318	2078	5728	11758

The Thickness of Walls for Dwelling Houses.—Brick.

Maximum Height = 100 feet. Maximum Length		
45 feet.	80 feet.	Unlimited.
inches Two stories of 21 Three „ 17½ Remainder... 13	inches Two stories of 26 Ditto „ 21½ Ditto „ 17½ Remainder... 13	inches One story of 30 Two „ 26 Ditto „ 21½ Ditto „ 17½ Remainder... 13
Maximum Height = 90 feet. Maximum Length		
45 feet.	70 feet.	Unlimited.
inches Two stories of 21½ Ditto „ 17½ Remainder... 13	inches One story of 26 Two „ 21½ Ditto „ 17½ Remainder... 13	inches One story of 30 Two „ 26 One „ 21½ Two „ 17½ Remainder... 13
Maximum Height = 80 feet. Maximum Length		
40 feet.	60 feet.	Unlimited.
inches One story of 21½ Two „ 17½ Remainder... 13	inches Two stories of 21½ Ditto „ 17½ Remainder... 13	inches One story of 26 Two „ 21½ Ditto „ 17½ Remainder... 13

The Thickness of Walls for Dwelling Houses—*continued.*

Maximum Height = 70 feet. Maximum Length		
40 feet.	55 feet.	Unlimited.
inches Two stories of $17\frac{1}{2}$ Remainder... 13	inches One story of $21\frac{1}{2}$ Two ,, $17\frac{1}{2}$ Remainder... 13	inches One story of 26 Two ,, $21\frac{1}{2}$ One ,, $17\frac{1}{2}$ Remainder... 13

Maximum Height = 60 feet. Maximum Length		
30 feet.	50 feet.	Unlimited.
inches One story of $17\frac{1}{2}$ Remainder... 13	inches Two stories of $17\frac{1}{2}$ Remainder... 13	inches One story of $21\frac{1}{2}$ Two ,, $17\frac{1}{2}$ Remainder... 13

Maximum Height = 50 feet. Maximum Length		
30 feet.	45 feet.	Unlimited.
inches Wall below the topmost story 13 Topmost story $8\frac{1}{2}$ Remainder ... $8\frac{1}{2}$	inches One story of... $17\frac{1}{2}$ Rest of wall below topmost story 13 Topmost story $8\frac{1}{2}$ Remainder ... $8\frac{1}{2}$	inches One story of $21\frac{1}{2}$ Ditto ,, $17\frac{1}{2}$ Remainder 13

THE THICKNESS OF WALLS FOR DWELLING HOUSES—*continued.*

Maximum Height = 40 feet.

Maximum Length: 35 feet.	inches	Maximum Length: Unlimited.	inches
Wall below two topmost stories	13	One story of	$17\frac{1}{2}$
Two topmost stories of	$8\frac{1}{2}$	Rest of wall below topmost story.........	13
Remainder	$8\frac{1}{2}$	Topmost story	$8\frac{1}{2}$
		Remainder	$8\frac{1}{2}$

Maximum Height = 30 feet.

Maximum Length: 35 feet.	inches	Maximum Length: Unlimited.	inches
Wall below two topmost stories	13	Wall below topmost story	13
Two topmost stories...	$8\frac{1}{2}$	Topmost story	$8\frac{1}{2}$
Remainder	$8\frac{1}{2}$	Remainder	$8\frac{1}{2}$

Maximum Height = 25 feet.

Maximum Length: 30 feet.	inches	Maximum Length: Unlimited.	inches
From base to top of wall	$8\frac{1}{2}$	Wall below topmost story	13
		Topmost story	$8\frac{1}{2}$
		Remainder	$8\frac{1}{2}$

The Thickness of Walls for Warehouses.—Brick.

Maximum Height in feet.	Maximum Length in feet.	Thickness at Base in inches.	Maximum Length in feet.	Thickness at Base in inches.	Maximum Length in feet.	Thickness at Base in inches.
100	55	26	70	30	Length unlimited	34
90	60	26	70	30		34
80	45	21½	60	26		30
70	30	17½	45	21½		26
60	35	17½	50	21½		26
50	40	17½	70	21½		26
40	30	13	60	17½		21½
30	45	13	—	—		17½
25	—	—	—	—		13

The thickness of the walls at the top for warehouses, and for 16 feet below the top shall =13 inches; and the intermediate parts of the wall between the base, and such 16 feet below the top to be solid throughout the space between straight lines drawn on each side of the wall from the base to the part 16 feet below the top, as above determined; but in walls not exceeding 30 feet in height, those of the topmost story may be 8½ inches thick.

The thickness to be increased to $\frac{1}{16}$th part of the height of the story for dwelling houses, and to $\frac{1}{14}$th part for warehouses, in case the thickness determined by the foregoing tables be less than that proportion.

The width of the Footings at the base to be *double* the thickness of the wall, to diminish in regular offsets, and to be equal in height to one-half of the width at base.

The thickness of Cross Walls to be *two-thirds* of the thickness of the external or party walls, but never less than $8\frac{1}{2}$ inches.

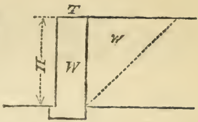
Walls of Rubble Stone.

The thickness of rubble stone walls to be one-third greater than those of brick.

Retaining Walls.

T = The mean thickness of the wall.
H = The height.
w = The weight of a cubic foot of the earth at back.
W = Ditto of the wall.

Wall with vertical sides and the earth horizontal at top.

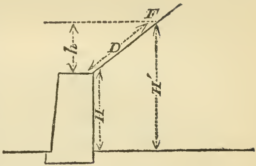


$$T = C\,H\sqrt{\frac{w}{W}}$$

C = .796 for earth semifluid.
.722 „ water.
.520 „ fine dry sand.
.477 „ earth soaked with water.
.412 „ earth in its natural state.

T = 1.00 wall with vertical sides.
.86 „ external batter of 1 in 12.
.80 „ „ 1 in 8.
.74 „ „ 1 in 6.
.72 „ „ 1 in 5.
.85 „ internal offsets and vertical face, but with $\frac{1}{7}$th less material than the vertical wall.

SURCHARGED REVETMENTS.



When the slope is of indefinite length, substitute for H in the last formula the vertical height H′, measured to the point F, found by setting off the distance D = H along the slope of the bank.

When the bank is of less height above the wall than the distance H would give, it will be near enough in practice to take the actual height instead of H in the formula.

Colonel Wurmbs in his *Text Book of Military Architecture*, gives the following formula to find the thickness of surcharged revetments:—

$$T = .845\,(H + h)\ \tan.\ \frac{a}{2}\sqrt{\frac{w}{W}}$$

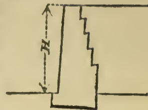
$$t = T + \tfrac{1}{10}\, n\, H.$$

T being the thickness of a wall with vertical sides; t, that of a sloping wall at base; n, the ratio of the batter to the height, as $\frac{1}{5}$, $\frac{1}{6}$, &c.; a, the angle which the natural slope of the earth makes with the vertical; H W and w as before.

Walls of great length should have counterforts at the back about 20 feet apart. Their thickness and depth should equal the mean thickness of the wall.

Retaining walls should be well drained at the back, and have "weepholes" in the proportion of one to every three superficial yards of wall to let the water escape.

The diagram shows the section of wall usually adopted in practice. The thickness for about one-third of the height from the base is made equal to $\frac{H}{3}$ and it is reduced towards the top in regular offsets at the back. The face is generally made to batter from about 1 in 6 to 1 in 10.



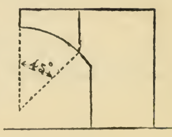
ARCHES.

$$\left.\begin{array}{ll} A = & \text{Area of section of half arch.} \\ D = & \text{Thickness at crown.} \\ H = & \text{Height of abutment to springing.} \\ P = & \text{Horizontal thrust at springing in terms} \\ & \quad\text{of the area.} \\ R = & \text{Radius of curvature at the crown.} \\ S = & \text{Span.} \\ T = & \text{Thickness of abutment.} \end{array}\right\} \text{all in feet.}$$

$$T = \sqrt{2P + \left(\frac{A}{H}\right)^2} - \frac{A}{H}$$

P = The weight of the half arch (in terms of the area) multiplied by the horizontal distance of its centre of gravity from the springing, and divided by the rise of the arch.

According to Professor Rankine, the Horizontal Thrust nearly equals the weight supported between the crown and that part of the soffit whose inclination is 45°.



$$D = C\sqrt{R}.$$

$C = 0.3$ block stone.
$= 0.4$ brick.
$= 0.45$ rubble.

In a straight arch of brick with radiating joints—

$$D = .45 \sqrt{S} + \frac{S}{12}$$

An arch of 40° is the flattest that can be constructed with safety when the depth at the crown$= C \sqrt{R}$.

Centre of Gravity.

If A denote a line joining the vertex and middle of the base of any figure, and D the distance of the centre of gravity from the vertex, then

Plane Triangle . . $D = \frac{2}{3} A$.
Cone or Pyramid . $D = \frac{3}{4} A$.
Semicircle . . . $D = \frac{5}{8} A$.
Circular segment . $D = \frac{2 \text{ chord} \times \text{radius}}{3 \text{ arc.}}$
Segment of a Sphere $D = \frac{8 \text{ rad} - 3 A}{12 \text{ rad} - 4 A}$
Semisphere . . . $D = \frac{5}{8} A$.
Paraboloid . . . $D = \frac{2}{3} A$.

Ventilation, &c.

The draught or velocity of air in feet per second from chimnies or ventilating shafts.

H = Height of shaft or of heated column of air in feet.

T = Temperature of room in deg. Fahr.

t = Temperature of external air.

$$\text{Velocity} = .365\sqrt{H\,(T-t)}$$

The retardation of the air by friction in passing through straight tubes will be directly as the length and square of the velocity and inversely as the diameter.

A full grown man requires at least 3 cubic feet of atmospheric air per minute.

Sleeping apartments require 1000 cubic feet of space for each occupant.

An ordinary window with the usual accuracy of fitting allows from 5 to 8 cubic feet of air to pass through per minute, according to the difference of temperature between the internal and external air.

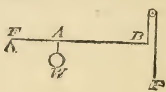
Levers.

W = The weight to be raised

P = The power.

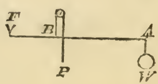
F = The fulcrum.

$$P = \frac{W \times A\,F}{F\,B}$$



$$W = \frac{P \times F\,B}{A\,F}$$

$$F\,B = \frac{W \times A\,F}{P}$$



$$A\,F = \frac{P \times F\,B}{W}$$

Pulley.

N = Number of sheaves in the lower block.
P = The power required.
W = The weight to be raised.

$$P=\frac{W}{2\,N}$$

Inclined Plane.

P = The power.
W = The weight.
L = The length of the plane.
H = The height.
B = The base or horizontal length.

When the line of traction is parallel to L

$$P=\frac{W\,H}{L}$$

$$W=\frac{P\,L}{H}$$

When the line of traction is parallel to B,

$$P=\frac{W\,H}{B}$$

$$W=\frac{P\,B}{H}$$

The Screw.

The screw is equal to an Inclined Plane, the circumference being equal to B, and the distance between two threads equal to H. $L=\sqrt{B^2+H^2}$.

When the screw is worked by a lever, as is generally the case, if C = the circumference of the circle formed by the end of the lever and through which the power P acts, and *d* the distance between two of the threads, then

$$W=\frac{P\,C}{d}$$

The Wedge.

When two bodies are forced asunder by means of a wedge in a direction parallel to its back.

Rule:—

As the length of the wedge is to half of its back or head, so is W to P.

When only one of the bodies is moveable.

Rule:—

As the length of the wedge is to its back, so is W to P.

Crabs and Cranes.

Let A, B, C, &c. = Diameters of the wheels.
$a, b, c,$ &c. = " pinions.
D = " drum or barrel.
H = " circle formed by the winch or handle.
P = Power applied to winch.
W = Weight to be raised.

Then

$$P = W \frac{D\,(a, b, c, \&c.)}{H\,(A, B, C, \&c.)}$$

$$W = P \frac{H\,(A, B, C, \&c.)}{D\,(a, b, c, \&c.)}$$

Allow 15 lbs. for each man turning the handle of a crab or crane, at a velocity of 200 feet per minute when the work is continuous, and 20 lbs. when there are intervals of rest, which is usually the case.

				inches.	
Radius of handle	=	from	15	to	18
Height of axle above ground...	=	"	33	to	36
Pitch of first motion wheels...	=	"	$1\frac{1}{4}$	to	$1\frac{1}{2}$
Their width.........................	=	"	3	to	4
Pitch of second movers.........	=	"	1	to	$1\frac{1}{4}$
Their width.........................	=	"	2	to	3

The pinion on the axle of the winch may have from 8 to 12 teeth.

ANIMAL POWER.

UNITS OF WORK RAISED ONE FOOT HIGH PER MINUTE.

Mean power of a man	....	4,700 lbs.
Ditto, turning a handle	....	3,000 ,,
Ditto, rowing	....	4,000 ,,
Ditto, raising water with a windlass	...	2,600 ,,
Ditto, ditto with a bucket and rope	...	1,100 ,,
Mean power of a horse	....	33,000 ,,
A man can pull with a force	.... =	80 lbs.
A horse ,,	.... =	560 ,,
A man can lift	.... =	112 ,,
Ditto carry on his shoulders	.. =	140 ,,
Ditto raise water from a well 10 feet high per minute	.... =	30 gallons.

A horse can carry on his back from 250 to 300 lbs. 20 miles per day.

If the power of a horse	= 1.00
That of a mule	= .60
Ditto ass	= .25
Ditto man	= .15

To move a stone along a rough chiselled floor requires	....	$\frac{2}{3}$rds of its weight.
Ditto on rollers	....	$\frac{1}{32}$,,
Ditto on wooden floor	....	$\frac{3}{5}$,,
Ditto on rollers	....	$\frac{1}{40}$,,

LINEAR EXPANSION BY HEAT FROM 32° TO 212°.
(Faraday).

Zinc......1 part in	322	Gold......1 part in	682
Lead...... ,,	349	Bismuth ,,	719
Tin, pure ,,	403	Iron, wrought ,,	846
,, impure ,,	500	,, cast ,,	901
Silver ... ,,	524	Antimony ,,	923
Copper... ,,	581	Platinum ,,	1131
Brass ... ,,	584	Flint Glass ,,	1248

Expansion of Liquids in Volume from 32° to 212°.

1000 parts of	water	....	become	1046
,, ,,	oil	....	,,	1080
,, ,,	mercury	......	,,	1018
,, ,,	spirits of wine		,,	1110
,, ,,	air	....	,,	1376

Expansion of Water on Freezing.

$= \frac{1}{12}$th part of its bulk.

Shrinkage of Castings.

The pattern maker's rule should be for

Cast iron ...	$\frac{1}{8}$	of an inch longer per lineal foot.
Brass	$\frac{3}{16}$	
Lead.........	$\frac{1}{8}$	
Tin	$\frac{1}{12}$	
Zinc	$\frac{5}{16}$	

The Relative Conducting Power of Materials used in Building.

Slate.........	100.	Brick, common	60.14
Plaster of Paris	20.26	,, fire	61.70
Plaster and sand	18.70	Bathstone	61.08
Roman cement .	20.80	Oak	33.66
Lath and plaster	25.55	Fir	27.60
Asphalte	45.19	Beech	22.44
Chalk	56.38	Lead...............	521.34

Lightning Conductors.

Lightning conductors should be attached to the building which they are intended to protect, and placed in communication with all metallic surfaces in the building, particularly the eaves-

gutters and down pipes. At the base the conductors should be let into moist ground, or connected with the gas or water pipes in the street ; or, should this be impracticable, and the ground is dry, it will be desirable to dig a shallow trench 10 or 15 feet long, and to lead the lower part of the rod, or a piece of old chain connected therewith, along the trench, and cover it with some powdered charcoal. The dryer the ground the longer the trench is required.

The relative conducting power of metals is as follows—

Silver	136
Gold	103
Copper	100
Zinc	28
Platinum	22
Iron	17
Lead	7

The size for lightning conductors considered desirable in practice is—

Copper rod, $\frac{3}{4}$ inch diameter.
" pipe $1\frac{1}{8}$ inch diameter and $\frac{1}{8}$ inch thick.
" flat bar, 3 inches wide by $\frac{1}{8}$ inch thick.
Iron rod, galvanized, $1\frac{3}{4}$ inch diameter.
" pipe " $2\frac{1}{2}$ inches diameter and $\frac{3}{8}$ inch thick.

The Hydraulic Press.

To find the thickness of metal in the cylinder, let

T=The thickness of metal in inches.
P=The pressure in tons per square inch on the piston.
R=The radius of the cylinder in inches.

Then for cast iron—

$$T = \frac{PR}{7 - P}$$

The power of the press will equal the force acting on the pump, multiplied by the area of the piston of the cylinder and divided by the area of the plunger or piston of the pump.

The Strength of Pipes.

Let D = The internal diameter in inches.
T = The thickness of metal in inches.
H = The head of water in feet required to burst the pipe.

Then

$$H = C\frac{T}{D}$$

$$T = \frac{DH}{C}$$

C = 200.000 for wrought iron.
73.000 " cast iron.
87.000 " copper.
83.000 " brass.
10.000 " lead.

In practice the thickness of cast iron water pipes is taken

$$= \tfrac{1}{5}\sqrt{\text{diameter.}}$$

Staircases.

Width of Tread.	Height of Riser.	Width of Tread.	Height of Riser.
6 inches	8½ inches	11 inches	6 inches
7 ,,	8 ,,	12 ,,	5½ ,,
8 ,,	7½ ,,	13 ,,	5 ,,
9 ,,	7 ,,	14 ,,	4½ ,,
10 ,,	6½ ,,	15 ,,	4 ,,

TABLES OF THE WEIGHTS OF MATERIALS.

The weight of wrought iron × 0.928 = cast iron.
" 0.928 = zinc.
" 1.010 = steel.
" 1.048 = brass.
" 1.134 = copper.
" 1.468 = lead.

THE WEIGHT OF WROUGHT IRON BOLT HEADS, NUTS AND WASHERS.

Diam. of Bolt.	Hexagon Heads and Nuts.	Square Heads and Nuts.	Round Washers.
inches.	per pair.	per pair.	per pair.
$\frac{1}{4}$	20 to a lb.	16 to a lb.	20 to a lb.
$\frac{3}{8}$	10 "	$8\frac{1}{3}$ "	10 "
$\frac{1}{2}$	5 "	$4\frac{1}{6}$ "	5 "
$\frac{5}{8}$	$2\frac{3}{4}$ "	$2\frac{1}{2}$ "	3 "
$\frac{3}{4}$	2 "	.56 lbs.	.63 lb.
$\frac{7}{8}$	.77 lbs.	.88	.77
1	1.25	1.31	1.25
$1\frac{1}{8}$	1.75	2.10	1.75
$1\frac{1}{4}$	2.13	2.56	2.25
$1\frac{3}{8}$	3.00	3.60	3.25
$1\frac{1}{2}$	3.75	4.42	4.25
$1\frac{5}{8}$	4.75	5.70	5.25
$1\frac{3}{4}$	5.75	7.00	6.50
$1\frac{7}{8}$	7.27	8.72	8.00
2	8.75	10.50	9.60
$2\frac{1}{2}$	17.00	21.00	19.00
3	28.80	36.40	32.50

Round and Square Iron.—Weight of a Lineal Foot.

Diam. or Side in inches.	Round in lbs.	Square in lbs.	Diam. or Side in inches.	Round in lbs.	Square in lbs.
$\frac{1}{8}$	.041	.053	$3\frac{5}{8}$	34.761	44.258
$\frac{1}{4}$	.165	.210	$3\frac{3}{4}$	37.199	47.363
$\frac{5}{16}$	.258	.329	$3\frac{7}{8}$	39.720	50.573
$\frac{3}{8}$	.372	.474	4	42.324	53.889
$\frac{7}{16}$	.506	.645	$4\frac{1}{8}$	45.011	57.310
$\frac{1}{2}$	.661	.842	$4\frac{1}{4}$	47.780	60 835
$\frac{9}{16}$	.837	1.066	$4\frac{3}{8}$	50.632	64.467
$\frac{5}{8}$	1.033	1.316	$4\frac{1}{2}$	53.567	68.203
$\frac{11}{16}$	1.250	1.592	$4\frac{5}{8}$	56.584	72.045
$\frac{3}{4}$	1.488	1.895	$4\frac{3}{4}$	59.684	75.992
$\frac{13}{16}$	1.746	2.223	$4\frac{7}{8}$	62.867	80.044
$\frac{7}{8}$	2.025	2.579	5	66.132	84.201
$\frac{15}{16}$	2.325	2.960	$5\frac{1}{8}$	69.480	88.464
1	2.645	3.368	$5\frac{1}{4}$	72.910	92.832
$1\frac{1}{8}$	3.348	4.263	$5\frac{3}{8}$	76.424	97.305
$1\frac{1}{4}$	4.133	5.263	$5\frac{1}{2}$	80.019	101.884
$1\frac{3}{8}$	5.001	6.368	$5\frac{5}{8}$	83.698	106.567
$1\frac{1}{2}$	5.952	7.578	$5\frac{3}{4}$	87.459	111.356
$1\frac{5}{8}$	6.985	8.894	$5\frac{7}{8}$	91.303	116.251
$1\frac{3}{4}$	8.101	10.315	6	95.230	121.250
$1\frac{7}{8}$	9.300	11.841	$6\frac{1}{4}$	103.331	131.565
2	10.581	13.472	$6\frac{1}{2}$	111.763	142.300
$2\frac{1}{8}$	11.945	15.209	$6\frac{3}{4}$	120.525	153.457
$2\frac{1}{4}$	13.392	17.051	7	129.618	165.035
$2\frac{3}{8}$	14.921	18.998	$7\frac{1}{2}$	148.796	189.453
$2\frac{1}{2}$	16.533	21.050	8	169.297	215.556
$2\frac{5}{8}$	18.228	23.208	$8\frac{1}{2}$	191.121	243.352
$2\frac{3}{4}$	20.205	25.471	9	214.267	272.812
$2\frac{7}{8}$	21.865	27.839	$9\frac{1}{2}$	238.736	303.967
3	23.807	30.312	10	264.527	336.806
$3\frac{1}{8}$	25.833	32.891	$10\frac{1}{2}$	291.641	371.328
$3\frac{1}{4}$	27.941	35.575	11	320.078	407.535
$3\frac{3}{8}$	30.131	38.364	$11\frac{1}{2}$	349.837	445.425
$3\frac{1}{2}$	32.405	41.259	12	380.919	485.000

Flat Bar Iron.—Weight of a Lineal Foot.

Width in inches.	Thickness in inches.												Width in inches.
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs.	lbs.	lbs.	lbs.	
$\frac{1}{16}$	.0132	.0263	.0395	.0526	.0658	.0789	.0921	.1053	.1316	.1579	.1842	.2105	$\frac{1}{16}$
$\frac{1}{8}$	.0263	.0526	.0789	.1053	.1316	.1579	.1842	.2105	.2631	.3158	.3684	.4210	$\frac{1}{8}$
$\frac{3}{16}$	.0395	.0789	.1184	.1579	.1973	.2368	.2763	.3158	.3947	.4736	.5526	.6315	$\frac{3}{16}$
$\frac{1}{4}$	.0526	.1053	.1579	.2105	.2631	.3158	.3684	.4210	.5263	.6315	.7368	.8420	$\frac{1}{4}$
$\frac{5}{16}$	.0658	.1316	.1973	.2631	.3289	.3947	.4605	.5263	.6578	.7894	.9210	1.053	$\frac{5}{16}$
$\frac{3}{8}$	.0789	.1579	.2368	.3158	.3947	.4736	.5526	.6315	.7894	.9473	1.105	1.263	$\frac{3}{8}$
$\frac{7}{16}$	.0921	.1842	.2763	.3684	.4605	.5526	.6447	.7368	.9210	1.105	1.289	1.474	$\frac{7}{16}$
$\frac{1}{2}$	.1053	.2105	.3158	.4210	.5263	.6315	.7368	.8420	1.053	1.263	1.474	1.684	$\frac{1}{2}$
$\frac{9}{16}$	.1184	.2368	.3552	.4736	.5920	.7104	.8289	.9473	1.184	1.421	1.658	1.895	$\frac{9}{16}$
$\frac{5}{8}$	.1316	.2631	.3947	.5263	.6578	.7894	.9210	1.053	1.316	1.579	1.842	2.105	$\frac{5}{8}$
$\frac{11}{16}$	.1447	.2894	.4342	.5789	.7236	.8683	1.013	1.158	1.447	1.737	2.026	2.316	$\frac{11}{16}$
$\frac{3}{4}$	.1579	.3158	.4736	.6315	.7894	.9473	1.105	1.263	1.579	1.895	2.210	2.526	$\frac{3}{4}$
$\frac{13}{16}$	.1710	.3421	.5131	.6841	.8552	1.026	1.197	1.368	1.710	2.052	2.394	2.737	$\frac{13}{16}$
$\frac{7}{8}$	.1842	.3684	.5526	.7368	.9210	1.105	1.289	1.474	1.842	2.210	2.579	2.947	$\frac{7}{8}$
$\frac{15}{16}$	.1973	.3947	.5920	.7894	.9867	1.184	1.381	1.579	1.973	2.368	2.763	3.158	$\frac{15}{16}$

Flat Bar Iron—*continued.*

Width in inches.	Thickness in inches.												Width in inches.
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1	.210	.421	.632	.842	1.053	1.263	1.474	1.684	2.105	2.526	2.947	3.368	1
$1\frac{1}{8}$	.237	.474	.710	.947	1.184	1.421	1.658	1.895	2.368	2.842	3.315	3.789	$1\frac{1}{8}$
$1\frac{1}{4}$	.263	.526	.789	1.053	1.316	1.579	1.842	2.105	2.631	3.158	3.684	4.210	$1\frac{1}{4}$
$1\frac{3}{8}$	.289	.579	.868	1.158	1.447	1.737	2.026	2.316	2.894	3.473	4.052	4.631	$1\frac{3}{8}$
$1\frac{1}{2}$	.316	.632	.947	1.263	1.579	1.895	2.210	2.526	3.158	3.789	4.421	5.052	$1\frac{1}{2}$
$1\frac{5}{8}$	.342	.684	1.026	1.368	1.710	2.052	2.394	2.737	3.421	4.105	4.789	5.473	$1\frac{5}{8}$
$1\frac{3}{4}$	.368	.737	1.105	1.474	1.842	2.210	2.579	2.947	3.684	4.421	5.157	5.894	$1\frac{3}{4}$
$1\frac{7}{8}$	.395	.789	1.184	1.579	1.973	2.368	2.763	3.158	3.947	4.736	5.526	6.315	$1\frac{7}{8}$
2	.421	.842	1.263	1.684	2.105	2.526	2.947	3.368	4.210	5.052	5.894	6.736	2
$2\frac{1}{8}$	.447	.895	1.342	1.789	2.237	2.684	3.131	3.579	4.473	5.368	6.262	7.157	$2\frac{1}{8}$
$2\frac{1}{4}$	.474	.947	1.421	1.895	2.368	2.842	3.315	3.789	4.736	5.684	6.831	7.578	$2\frac{1}{4}$
$2\frac{3}{8}$	.500	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.999	5.999	6.999	7.999	$2\frac{3}{8}$
$2\frac{1}{2}$	.526	1.053	1.579	2.105	2.631	3.158	3.684	4.210	5.263	6.315	7.368	8.420	$2\frac{1}{2}$
$2\frac{5}{8}$	.553	1.105	1.658	2.210	2.763	3.315	3.868	4.421	5.526	6.631	7.736	8.841	$2\frac{5}{8}$
$2\frac{3}{4}$	.579	1.158	1.737	2.316	2.894	3.473	4.052	4.631	5.789	6.947	8.104	9.262	$2\frac{3}{4}$
$2\frac{7}{8}$	.605	1.210	1.816	2.421	3.026	3.631	4.236	4.842	6.052	7.262	8.473	9.683	$2\frac{7}{8}$

Flat Bar Iron—*continued.*

Width in inches.	Thickness in inches.												Width in inches.
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
3	.632	1.263	1.895	2.526	3.158	3.789	4.421	5.052	6.315	7.578	8.841	10.104	3
$3\frac{1}{4}$	.684	1.368	2.052	2.737	3.421	4.105	4.789	5.473	6.841	8.210	9.578	10.946	$3\frac{1}{4}$
$3\frac{1}{2}$	.737	1.474	2.210	2.947	3.684	4.421	5.157	5.894	7.368	8.841	10.315	11.788	$3\frac{1}{2}$
$3\frac{3}{4}$	.789	1.579	2.368	3.158	3.947	4.736	5.526	6.315	7.894	9.473	11.051	12.630	$3\frac{3}{4}$
4	.842	1.684	2.526	3.368	4.210	5.052	5.894	6.736	8.420	10.104	11.788	13.472	4
$4\frac{1}{4}$	.895	1.789	2.684	3.579	4.473	5.368	6.262	7.157	8.946	10.736	12.525	14.314	$4\frac{1}{4}$
$4\frac{1}{2}$	.947	1.895	2.842	3.789	4.736	5.684	6.631	7.578	9.473	11.367	13.262	15.156	$4\frac{1}{2}$
$4\frac{3}{4}$	1.000	2.000	3.000	4.000	4.999	5.999	6.999	7.999	9.999	11.999	13.998	15.998	$4\frac{3}{4}$
5	1.053	2.105	3.158	4.210	5.263	6.315	7.368	8.420	10.525	12.630	14.735	16.840	5
$5\frac{1}{4}$	1.105	2.210	3.315	4.421	5.526	6.631	7.736	8.841	11.051	13.262	15.472	17.682	$5\frac{1}{4}$
$5\frac{1}{2}$	1.158	2.316	3.473	4.631	5.789	6.947	8.104	9.262	11.578	13.893	16.209	18.524	$5\frac{1}{2}$
$5\frac{3}{4}$	1.210	2.421	3.631	4.842	6.052	7.262	8.473	9.683	12.104	14.525	16.946	19.366	$5\frac{3}{4}$
6	1.263	2.526	3.789	5.052	6.315	7.578	8.841	10.104	12.630	15.156	17.682	20.208	6

Round Cast-Iron.

The weight of a lineal foot.

Diam. in inches.	Weight in lbs.	Diam. in inches.	Weight in lbs.	Diam. in inches.	Weight in lbs.
1	2.454	$5\frac{1}{2}$	74.245	10	245.437
$1\frac{1}{4}$	3.835	$5\frac{3}{4}$	81.148	$10\frac{1}{4}$	257.863
$1\frac{1}{2}$	5.522	6	88.357	$10\frac{1}{2}$	270.595
$1\frac{3}{4}$	7.517	$6\frac{1}{4}$	95.874	$10\frac{3}{4}$	283.634
2	9.818	$6\frac{1}{2}$	103.697	11	296.979
$2\frac{1}{4}$	12.425	$6\frac{3}{4}$	111.827	$11\frac{1}{4}$	310.632
$2\frac{1}{2}$	15.340	7	120.264	$11\frac{1}{2}$	324.591
$2\frac{3}{4}$	18.561	$7\frac{1}{4}$	129.008	$11\frac{3}{4}$	338.857
3	22.089	$7\frac{1}{2}$	138.059	12	353.430
$3\frac{1}{4}$	25.924	$7\frac{3}{4}$	147.416	13	414.789
$3\frac{1}{2}$	30.066	8	157.080	14	481.057
$3\frac{3}{4}$	34.515	$8\frac{1}{4}$	167.051	15	552.234
4	39.270	$8\frac{1}{2}$	177.329	16	628.320
$4\frac{1}{4}$	44.332	$8\frac{3}{4}$	187.913	17	709.314
$4\frac{1}{2}$	49.701	9	198.804	18	795.217
$4\frac{3}{4}$	55.377	$9\frac{1}{4}$	210.002	20	981.750
5	61.359	$9\frac{1}{2}$	221.507	22	1187.917
$5\frac{1}{4}$	67.649	$9\frac{3}{4}$	233.319	24	1413.720

Round, Octagonal, and Square Steel.—The Weight of a Lineal Foot.

Diameter of Circle and Oct. and Side of Square.	Round in lbs.	Octagonal in lbs.	Square in lbs.
$\frac{1}{8}$	.0417	.0440	.0532
$\frac{3}{16}$	.0940	.0991	.1196
$\frac{1}{4}$	.1670	.1762	.2127
$\frac{5}{16}$	.2610	.2753	.3323
$\frac{3}{8}$	.3758	.3964	.4785
$\frac{7}{16}$	.5115	.5396	.6513
$\frac{1}{2}$	.6681	.7047	.8507
$\frac{9}{16}$	.8456	.8919	1.077
$\frac{5}{8}$	1.044	1.101	1.329
$\frac{11}{16}$	1.263	1.332	1.608
$\frac{3}{4}$	1.503	1.586	1.914
$\frac{13}{16}$	1.764	1.861	2.246
$\frac{7}{8}$	2.046	2.158	2.605
$\frac{15}{16}$	2.349	2.478	2.991
1	2.673	2.819	3.403
$1\frac{1}{8}$	3.382	3.568	4.307
$1\frac{1}{4}$	4.176	4.405	5.317
$1\frac{3}{8}$	5.053	5.330	6.433
$1\frac{1}{2}$	6.013	6.343	7.656
$1\frac{5}{8}$	7.057	7.444	8.985
$1\frac{3}{4}$	8.185	8.633	10.421
$1\frac{7}{8}$	9.396	9.910	11.963
2	10.690	11.276	13.611
$2\frac{1}{4}$	13.530	14.271	17.227
$2\frac{1}{2}$	16.703	17.618	21.267
$2\frac{3}{4}$	20.211	21.318	25.734
3	24.053	25.371	30.625

Note.—The diameter of Octagon steel is measured across the sides.

Flat Steel.—The Weight of a Lineal Foot.

Width in inches.	Thickness in inches.							
	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
$\frac{1}{8}$	.0532	.1063	.1595	.2127	.2658	.3190	.3722	.4253
$\frac{1}{2}$	.2127	.4253	.6380	.8507	1.063	1.276	1.489	1.701
$\frac{5}{8}$	.2658	.5317	.7975	1.063	1.329	1.595	1.861	2.127
$\frac{3}{4}$	.3190	.6380	.9570	1.276	1.595	1.914	2.233	2.552
$\frac{7}{8}$	.3722	.7443	1.117	1.489	1.861	2.233	2.605	2.977
1	.4253	.8507	1.276	1.701	2.127	2.552	2.976	3.403
$1\frac{1}{8}$	.4785	.9570	1.436	1.914	2.393	2.871	3.350	3.828
$1\frac{1}{4}$	.5317	1.063	1.595	2.127	2.658	3.190	3.722	4.253
$1\frac{3}{8}$	.5849	1.170	1.755	2.339	2.924	3.509	4.094	4.679
$1\frac{1}{2}$	.6380	1.276	1.914	2.552	3.190	3.828	4.466	5.104
$1\frac{3}{4}$	.7444	1.489	2.233	2.977	3.722	4.466	5.211	5.955
2	.8507	1.701	2.552	3.403	4.253	5.104	5.955	6.806
$2\frac{1}{4}$	.9570	1.914	2.871	3.828	4.785	5.742	6.699	7.656
$2\frac{1}{2}$	1.063	2.127	3.190	4.253	5.317	6.380	7.444	8.507
$2\frac{3}{4}$	1.170	2.339	3.509	4.679	5.849	7.018	8.188	9.358
3	1.276	2.552	3.828	5.104	6.380	7.656	8.932	10.208
$3\frac{1}{4}$	1.382	2.765	4.147	5.530	6.912	8.294	9.677	11.059
$3\frac{1}{2}$	1.489	2.977	4.466	5.955	7.444	8.932	10.421	11.910
$3\frac{3}{4}$	1.595	3.190	4.785	6.380	7.975	9.570	11.165	12.760
4	1.701	3.403	5.104	6.806	8.507	10.208	11.910	13.611
$4\frac{1}{4}$	1.808	3.615	5.423	7.231	9.039	10.846	12.654	14.462
$4\frac{1}{2}$	1.914	3.828	5.742	7.656	9.570	11.484	13.398	15.313
$4\frac{3}{4}$	2.020	4.041	6.061	8.082	10.102	12.122	14.143	16.163
5	2.127	4.254	6.380	8.507	10.634	12.760	14.887	17.014
$5\frac{1}{2}$	2.339	4.679	7.018	9.358	11.697	14.037	16.376	18.715
6	2.552	5.104	7.656	10.208	12.761	15.313	17.865	20.417

Copper Bar.—The Weight of a Lineal Foot

Diam. or Side in in.	Round in lbs.	Square in lbs.	Diam. or Side.	Round in lbs.	Square in lbs.
$\frac{1}{8}$	.047	.060	$1\frac{1}{2}$	6.811	8.672
$\frac{3}{16}$	.106	.135	$1\frac{9}{16}$	7.390	9.410
$\frac{1}{4}$	.189	.241	$1\frac{5}{8}$	7.993	10.177
$\frac{5}{16}$	.296	.376	$1\frac{3}{4}$	9.270	11.803
$\frac{3}{8}$	.426	.542	$1\frac{7}{8}$	10.642	13.550
$\frac{7}{16}$	.579	.738	2	12.108	15.417
$\frac{1}{2}$	.757	.964	$2\frac{1}{8}$	13.668	17.404
$\frac{9}{16}$	.958	1.219	$2\frac{1}{4}$	15.325	19.512
$\frac{5}{8}$	1.182	1.506	$2\frac{3}{8}$	17.075	21.740
$\frac{11}{16}$	1.431	1.822	$2\frac{1}{2}$	18.916	24.089
$\frac{3}{4}$	1.703	2.168	$2\frac{5}{8}$	20.856	26.558
$\frac{13}{16}$	1.998	2.544	$2\frac{3}{4}$	22.891	29.146
$\frac{7}{8}$	2.318	2.951	$2\frac{7}{8}$	25.019	31.856
$\frac{15}{16}$	2.661	3.387	3	27.244	34.688
1	3.027	3.854	$3\frac{1}{8}$	29.559	37.638
$1\frac{1}{16}$	3.417	4.351	$3\frac{1}{4}$	31.972	40.710
$1\frac{1}{8}$	3.831	4.878	$3\frac{3}{8}$	34.482	43.901
$1\frac{3}{16}$	4.269	5.435	$3\frac{1}{2}$	37.081	47.214
$1\frac{1}{4}$	4.730	6.022	$3\frac{5}{8}$	39.777	50.646
$1\frac{5}{16}$	5.214	6.634	$3\frac{3}{4}$	42.568	54.199
$1\frac{3}{8}$	5.723	7.287	$3\frac{7}{8}$	45.550	57.873
$1\frac{7}{16}$	6.255	7.964	4	48.433	61.667

Round and Square Brass.—The Weight of a Lineal Foot.

Diam. or Side in in.	Round in lbs.	Square in lbs.	Diam. or Side in in.	Round in lbs.	Square in lbs.
$\frac{1}{16}$	.0112	.0142	$1\frac{5}{16}$	4.933	6.281
$\frac{1}{8}$	.0447	.0570	$1\frac{3}{8}$	5.414	6.893
$\frac{3}{16}$	.1012	.1282	$1\frac{7}{16}$	5.918	7.534
$\frac{1}{4}$	.1790	.2279	$1\frac{1}{2}$	6.443	8.203
$\frac{5}{16}$	.2796	.3560	$1\frac{9}{16}$	6.991	8.901
$\frac{3}{8}$	.4047	.5127	$1\frac{5}{8}$	7.563	9.627
$\frac{7}{16}$	.5486	.6978	$1\frac{11}{16}$	8.155	10.382
$\frac{1}{2}$	.7159	.9115	$1\frac{3}{4}$	8.789	11.165
$\frac{9}{16}$	.9060	1.154	$1\frac{13}{16}$	9.407	11.977
$\frac{5}{8}$	1.118	1.424	$1\frac{7}{8}$	10.117	12.817
$\frac{11}{16}$	1.353	1.723	$1\frac{15}{16}$	10.799	13.686
$\frac{3}{4}$	1.611	2.051	2	11.454	14.583
$\frac{13}{16}$	1.891	2.407	$2\frac{1}{8}$	12.932	16.463
$\frac{7}{8}$	2.194	2.791	$2\frac{1}{4}$	14.496	18.457
$\frac{15}{16}$	2.529	3.204	$2\frac{3}{8}$	16.152	20.565
1	2.863	3.646	$2\frac{1}{2}$	17.896	22.786
$1\frac{1}{16}$	3.233	4.116	$2\frac{5}{8}$	19.731	25.122
$1\frac{1}{8}$	3.624	4.614	$2\frac{3}{4}$	21.655	27.572
$1\frac{3}{16}$	4.038	5.141	$2\frac{7}{8}$	23.670	30.135
$1\frac{1}{4}$	4.474	5.697	3	25.771	32.813

Sheet Iron.—Weight of a Superficial Foot.

B. W. Gauge.	Dec. of an inch.	Weight in lbs.	B. W. Gauge.	Dec. of an inch.	Weight in lbs.
00000 ($\frac{1}{2}$)	.500	20.208	16 ($\frac{1}{16}$)	.063	2.546
0000	.450	18.187	17	.055	2.223
000	.437	17.662	18	.048	1.940
00 ($\frac{3}{8}$)	.375	15.156	19	.042	1.697
0	.340	13.742	20	.035	1.415
1 ($\frac{5}{16}$)	.312	12.610	21	.033	1.334
2	.284	11.477	22	.029	1.172
3	.261	10.549	23	.028	1.132
3—4 ($\frac{1}{4}$)	.250	10.104	24	.025	1.014
4	.239	9.660	25	.021	.849
5	.217	8.770	26	.020	.808
6	.208	8.407	27	.018	.727
7 ($\frac{3}{16}$)	.187	7.558	28	.015	.606
8	.166	6.709	29	.013	.525
9	.158	6.386	30	.012	.485
10	.137	5.537	31	.010	.404
11 ($\frac{1}{8}$)	.125	5.052	32	.009	.364
12	.109	4.405	33	.008	.323
13	.094	3.799	34	.007	.283
14	.080	3.233	35	.005	.202
15	.072	2.910	36	.004	.162

Hoop Iron.—Weight of 100 Lineal Feet.

B. W. Gauge.	Width in ins.	Weight in lbs.	B. W. Gauge.	Width in ins.	Weight in lbs.
11	3	126.302	15	$1\frac{1}{2}$	36.375
11	$2\frac{3}{4}$	115.777	15	$1\frac{3}{8}$	33.344
12	$2\frac{1}{2}$	91.780	16	$1\frac{1}{4}$	26.523
12	2	73.424	17	$1\frac{1}{8}$	20.840
13	$2\frac{1}{4}$	71.234	18	1	16.167
13	2	63.319	19	$\frac{7}{8}$	12.378
13	$1\frac{3}{4}$	55.405	20	$\frac{3}{4}$	8.841
14	$1\frac{3}{4}$	47.153	21	$\frac{5}{8}$	6.947
14	$1\frac{1}{2}$	40.417			

Chains.—Weight of a Lineal Foot.

Diam. of Link inches.	Weight in lbs.
$\frac{1}{4}$	.63
$\frac{5}{16}$	.91
$\frac{3}{8}$	1.33
$\frac{7}{16}$	1.50
$\frac{1}{2}$	2.33
$\frac{9}{16}$	3.00
$\frac{5}{8}$	3.67
$\frac{11}{16}$	4.50
$\frac{3}{4}$	5.33
$\frac{13}{16}$	6.16
$\frac{7}{8}$	7.16
$\frac{15}{16}$	8.16
1	9.33
$1\frac{1}{16}$	10.50
$1\frac{1}{8}$	11.83
$1\frac{3}{16}$	13.16
$1\frac{1}{4}$	14.50
$1\frac{5}{16}$	16.00
$1\frac{3}{8}$	17.66
$1\frac{1}{2}$	20.83
$1\frac{5}{8}$	24.17
$1\frac{3}{4}$	28.33
$1\frac{7}{8}$	32.50
2	38.33

Note.—The Chains over 1 inch diameter are assumed to be made with studs.

Various Metals.—The Weight of a Superficial Foot.

Thickness in inches.	Wrought Iron.	Cast Iron.	Steel.	Copper.	Brass.	Lead.	Zinc.	Thickness in inches.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1/16	2.526	2.344	2.552	2.891	2.734	3.708	2.344	1/16
1/8	5.052	4.687	5.104	5.781	5.469	7.417	4.687	1/8
3/16	7.578	7.031	7.656	8.672	8.203	11.125	7.031	3/16
1/4	10.104	9.375	10.208	11.563	10.938	14.833	9.375	1/4
5/16	12.630	11.719	12.760	14.453	13.672	18.542	11.719	5/16
3/8	15.156	14.062	15.312	17.344	16.406	22.250	14.062	3/8
7/16	17.682	16.406	17.865	20.234	19.141	25.958	16.406	7/16
1/2	20.208	18.750	20.417	23.125	21.875	29.667	18.750	1/2
9/16	22.734	21.094	22.969	26.016	24.609	33.375	21.094	9/16
5/8	25.260	23.437	25.521	28.906	27.344	37.083	23.437	5/8
11/16	27.786	25.781	28.073	31.797	30.078	40.792	25.781	11/16
3/4	30.312	28.125	30.625	34.688	32.813	44.500	28.125	3/4
13/16	32.839	30.469	33.177	37.578	35.547	48.208	30.469	13/16
7/8	35.365	32.812	35.729	40.469	38.281	51.917	32.812	7/8
15/16	37.891	35.156	38.281	43.359	41.016	55.625	35.156	15/16
1	40.417	37.500	40.833	46.250	43.750	59.333	37.500	1

Wrought Iron Pipes.—The Weight of a Lineal Foot.

Bore in inches.	Thickness of Metal in Parts of an inch.								Bore in inches.
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
$\frac{1}{4}$	.208	.497	.869	1.324	1.861	2.481	3.184	3.969	$\frac{1}{4}$
$\frac{3}{8}$	.289	.661	1.116	1.653	2.273	2.976	3.761	4.629	$\frac{3}{8}$
$\frac{1}{2}$	.372	.827	1.364	1.984	2.687	3.472	4.340	5.291	$\frac{1}{2}$
$\frac{5}{8}$	.455	1.092	1.612	2.315	3.100	3.968	4.919	5.952	$\frac{5}{8}$
$\frac{3}{4}$	.537	1.157	1.860	2.645	3.513	4.464	5.497	6.613	$\frac{3}{4}$
$\frac{7}{8}$	.620	1.323	2.108	2.976	3.927	4.960	6.076	7.274	$\frac{7}{8}$
1	.703	1.488	2.356	3.307	4.340	5.456	6.654	7.936	1
$1\frac{1}{4}$	.868	1.819	2.852	3.968	5.167	6.448	7.812	9.258	$1\frac{1}{4}$
$1\frac{1}{2}$	1.033	2.149	3.348	4.629	5.993	7.440	8.969	10.581	$1\frac{1}{2}$
$1\frac{3}{4}$	1.199	2.480	3.844	5.291	6.820	8.432	10.126	11.904	$1\frac{3}{4}$
2	1.364	2.811	4.340	5.952	7.646	9.424	11.284	13.226	2
$2\frac{1}{4}$	1.529	3.131	4.836	6.613	8.473	10.416	12.441	14.549	$2\frac{1}{4}$
$2\frac{1}{2}$	1.695	3.472	5.332	7.274	9.300	11.408	13.598	15.872	$2\frac{1}{2}$
$2\frac{3}{4}$	1.860	3.803	5.828	7.936	10.126	12.400	14.756	17.194	$2\frac{3}{4}$
3	2.025	4.133	6.324	8.607	10.953	13.392	15.913	18.517	3

Cast Iron Pipes.—The Weight of a Lineal Foot.

Bore in inches.	Thickness of Metal in inches.										Bore in inches.
	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
2	5.522	8.744	12.272	16.107	20.249	24.697	29.452	34.515	39.884	51.542	2
$2\frac{1}{4}$	6.136	9.664	13.499	17.641	22.089	26.845	31.907	37.276	42.952	55.223	$2\frac{1}{4}$
$2\frac{1}{2}$	6.750	10.584	14.726	19.175	23.950	28.992	34.361	40.037	46.019	58.905	$2\frac{1}{2}$
$2\frac{3}{4}$	7.363	11.505	15.953	20.709	25.771	31.140	36.816	42.798	49.087	62.587	$2\frac{3}{4}$
3	7.977	12.425	17.181	22.243	27.612	32.287	39.270	45.559	52.155	66.268	3
$3\frac{1}{4}$	8.590	13.346	18.408	23.777	29.452	35.435	41.724	48.320	55.223	69.950	$3\frac{1}{4}$
$3\frac{1}{2}$	9.204	14.266	19.635	25.311	31.293	37.583	44.179	51.082	58.291	73.631	$3\frac{1}{2}$
$3\frac{3}{4}$	9.817	15.186	20.862	26.845	33.134	39.730	46.633	53.843	61.359	77.313	$3\frac{3}{4}$
4	10.431	16.109	22.089	28.379	34.975	41.878	49.087	56.604	64.427	80.994	4
$4\frac{1}{4}$	11.045	17.027	23.317	29.913	36.816	44.025	51.542	59.365	67.495	84.676	$4\frac{1}{4}$
$4\frac{1}{2}$	11.658	17.948	24.544	31.447	38.656	46.177	53.996	62.126	70.563	88.357	$4\frac{1}{2}$
$4\frac{3}{4}$	12.272	18.868	25.771	32.981	40.497	48.320	56.451	64.888	73.631	92.039	$4\frac{3}{4}$

Cast Iron Pipes—*continued.*

Bore in inches.	Thickness of Metal in inches.										Bore in inches.
	¼	¾	½	⅝	¾	⅞	1	1⅛	1¼	1½	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
5	12.885	19.788	26.998	34.515	42.338	50.468	58.905	67.649	76.699	95.721	4
5½	14.113	21.629	29.452	37.583	46.020	54.763	63.814	73.171	82.835	103.084	4¼
6	15.340	23.470	31.908	40.651	49.701	59.058	68.722	78.693	88.971	110.447	4½
6½	16.567	25.311	34.361	43.719	53.383	63.354	73.631	84.216	95.107	117.810	4¾
7	17.794	27.152	36.816	46.787	57.064	67.649	78.540	89.738	101.243	125.173	7
7½	19.021	28.992	39.270	49.854	60.746	71.944	83.449	95.260	107.379	132.536	7½
8	20.249	30.833	41.724	52.922	64.427	76.239	88.357	100.783	113.515	139.899	8
8½	21.476	32.674	44.179	55.990	68.109	80.534	93.266	106.305	119.651	147.262	8½
9	22.703	34.515	46.633	59.058	71.790	84.829	98.175	111.827	125.787	154.626	9
9½	23.930	36.355	49.087	62.126	75.472	89.124	103.084	117.350	131.923	161.989	9½
10	25.157	38.196	51.541	65.194	79.154	93.420	107.992	122.872	138.059	169.352	10
10½	26.385	40.037	53.996	68.262	82.835	97.715	112.901	128.394	144.195	176.715	10½
11	27.612	41.878	56.451	71.330	86.517	102.010	117.810	133.917	150.330	184.078	11
12	30.066	45.559	61.359	77.466	93.880	110.600	127.627	144.962	162.602	198.804	12
13	32.520	49.241	66.268	83.602	101.243	119.191	137.445	156.006	174.874	213.531	13
14	34.975	52.922	71.177	89.738	108.606	127.781	147.262	167.051	187.146	228.257	14

Bore in inches.	Thickness of Metal in inches.									Bore in inches.
	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
15	56.604	76.086	95.874	115.969	136.371	157.080	178.096	199.418	242.983	15
16	60.286	80.994	102.010	123.332	144.962	166.897	189.140	211.690	257.709	16
17	63.967	85.903	108.146	130.695	153.552	176.715	200.185	223.962	272.436	17
18	67.649	90.812	114.282	138.059	162.142	186.532	211.230	236.234	287.162	18
19	...	95.721	120.418	145.422	170.732	196.350	221.273	248.505	301.888	19
20	...	100.629	126.554	152.785	179.323	206.167	233.319	260.777	316.614	20
21	...	105.538	132.690	160.148	187.913	215.985	244.364	273.049	331.341	21
22	..	110.447	138.826	167.511	196.503	225.802	255.408	285.321	346.067	22
23	...	115.356	144.962	174.874	205.094	235.620	266.453	297.593	360.793	23
24	..	120.264	151.097	182.237	213.684	245.437	277.498	309.865	375.519	24
25	...	125.173	157.233	189.600	222.274	255.255	288.542	322.137	390.246	25
26	...	130.082	163.369	196.964	230.865	265.072	299.587	334.409	404.972	26
27	...	134.991	169.505	204.327	239.455	274.890	310.632	346.680	419.698	27
28	...	139.899	175·641	211.690	248.045	284.707	321.677	358.952	434.424	28
29	...	144.808	181.776	219.053	256.636	294.525	332.721	371.224	449.151	29
30	...	149.717	187.913	226.416	265.226	304.342	343.766	383.496	463.877	30

Note.—For each joint add the weight of a foot in length of the pipe.

Table of the Weight of Cast-Iron Socket Jointed Pipes.

(Hawksley).

Bore.	Length over Joint.		Net Length in work.		Thickness of Metal.	Weight per Pipe.			No. of Belts per Pipe.
inches.	feet.	in.	feet.	in.	inches.	cwt.	qrs.	lbs.	
1½	4	9	4	6	.288	0	1	0	None
2	6	4	6	0	.300	0	1	21	—
2½	6	4	6	0	.313	0	2	5	—
3	9	4	9	0	.325	0	3	24	—
4	...		...		.350	1	1	12	Two
5	...		...		.375	1	3	6	—
6	9	6	...		.400	2	1	4	—
7	...		...		.425	2	3	8	—
8	...		...		.450	3	1	15	—
9	...		...		.475	4	0	2	—
10	...		...		.500	4	2	21	—
11	...		...		.525	5	0	17	—
12	...		...		.550	6	1	0	—
13	...		...		.575	6	3	14	—
14	9	8	..		.593	7	2	20	—
15	...		...		.612	8	1	13	—

Table of the Weight of Cast-Iron Flanged Pipes in Nine Feet Lengths.

(Nystrom).

Bore in inches.	Thickness of Metal.	Diameter of Flanges.	Thickness of Flanges.	Diameter of Circle through Holes.	Diameter and Number of Holes.		Weight per Pipe.		
	inches.	inches.	inches.	inches.	inches.	No.	cwt.	qrs.	lbs.
2	$\frac{3}{8}$	$6\frac{1}{2}$	$\frac{9}{16}$	$4\frac{3}{4}$	$\frac{5}{8}$	4	0	3	0
3	$\frac{3}{8}$	$7\frac{1}{2}$	$\frac{5}{8}$	6	$\frac{5}{8}$	4	1	0	3
4	$\frac{1}{2}$	$9\frac{1}{2}$	$\frac{3}{4}$	$7\frac{3}{4}$	$\frac{3}{4}$	4	1	3	5
5	$\frac{1}{2}$	$10\frac{1}{2}$	$\frac{7}{8}$	$8\frac{3}{4}$	$\frac{3}{4}$	4	2	1	12
6	$\frac{5}{8}$	12	$\frac{7}{8}$	10	$\frac{7}{8}$	4	3	2	1
7	$\frac{5}{8}$	14	1	$11\frac{3}{4}$	1	6	4	3	17
8	$\frac{3}{4}$	15	1	$12\frac{3}{4}$	1	6	5	2	9
9	$\frac{3}{4}$	$16\frac{1}{2}$	$1\frac{1}{16}$	$14\frac{1}{4}$	1	6	6	1	12
10	$\frac{3}{4}$	$17\frac{1}{2}$	$1\frac{1}{8}$	$15\frac{1}{2}$	1	6	7	0	0
11	$\frac{7}{8}$	19	$1\frac{3}{16}$	$16\frac{3}{4}$	1	6	8	3	24
12	$\frac{7}{8}$	20	$1\frac{1}{4}$	$17\frac{3}{4}$	$1\frac{1}{8}$	6	9	3	5
13	$\frac{7}{8}$	21	$1\frac{1}{4}$	$18\frac{3}{4}$	$1\frac{1}{8}$	6	10	2	0
14	$\frac{7}{8}$	22	$1\frac{1}{4}$	$19\frac{3}{4}$	$1\frac{1}{8}$	8	11	0	26
15	$\frac{7}{8}$	23	$1\frac{1}{4}$	$20\frac{3}{4}$	$1\frac{1}{8}$	8	12	0	25
16	$\frac{7}{8}$	$24\frac{1}{2}$	$1\frac{5}{16}$	22	$1\frac{1}{4}$	8	12	3	8
17	$\frac{7}{8}$	$25\frac{1}{2}$	$1\frac{5}{16}$	23	$1\frac{1}{4}$	8	13	2	17
18	1	$26\frac{1}{2}$	$1\frac{3}{8}$	24	$1\frac{1}{4}$	8	16	1	15
19	1	28	$1\frac{3}{8}$	25	$1\frac{3}{8}$	8	17	2	13
20	1	29	$1\frac{3}{8}$	26	$1\frac{3}{8}$	8	18	0	26

COPPER PIPES.—THE WEIGHT OF A LINEAL FOOT.

Bore in inches.	Thickness of Metal in parts of an inch.							
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
$\frac{3}{16}$	.189	.473	.851	1.324	1.892	2.554	3.311	4.162
$\frac{1}{4}$	.236	.568	.993	1.514	2.128	2.838	3.642	4.541
$\frac{5}{16}$	.284	.662	1.135	1.703	2.365	3.121	3.973	4.918
$\frac{3}{8}$	.331	.757	1.277	1.892	2.601	3.406	4.304	5.297
$\frac{7}{16}$	.378	.851	1.419	2.081	2.838	3.689	4.635	5.675
$\frac{1}{2}$	.426	.946	1.561	2.270	3.075	3.973	4.966	6.054
$\frac{9}{16}$	.473	1.040	1.703	2.459	3.311	4.256	5.297	6.432
$\frac{5}{8}$	.520	1.185	1.845	2.649	3.547	4.540	5.629	6.811
$\frac{11}{16}$	.568	1.230	1.986	2.838	3.783	4.824	5.959	7.190
$\frac{3}{4}$	.615	1.324	1.129	3.027	4.020	5.108	6.290	7.568
$\frac{13}{16}$	.662	1.419	2.271	3.216	4.257	5.392	6.622	7.946
$\frac{7}{8}$	.709	1.514	2.412	3.405	4.493	5.676	6.953	8.324
$\frac{15}{16}$	.757	1.608	2.554	3.594	4.729	5.960	7.284	8.703
1	.804	1.703	2.696	3.784	4.966	6.243	7.615	9.081
$1\frac{1}{4}$	.993	2.081	3.263	4.540	5.912	7.378	8.938	10.595
$1\frac{1}{2}$	1.182	2.459	3.831	5.297	6.857	8.514	10.264	12.105
$1\frac{3}{4}$	1.372	2.838	4.398	6.055	7.805	9.646	11.586	13.621
2	1.560	3.217	4.967	6.808	8.748	10.783	12.911	15.135
$2\frac{1}{4}$	1.750	3.591	5.531	7.566	9.694	11.918	14.234	16.647
$2\frac{1}{2}$	1.940	3.975	6.103	8.327	10.643	13.066	15.565	18.165
$2\frac{3}{4}$	2.128	4.352	6.668	9.081	11.590	14.190	16.886	19.677
3	2.316	4.729	7.238	9.737	12.534	15.325	18.212	21.190

Brass Pipes.—The Weight of a Lineal Foot.

Bore in inches.	Thickness of Metal in parts of an inch.							
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
$\frac{3}{16}$	.178	.447	.805	1.252	1.790	2.428	3.132	3.937
$\frac{1}{4}$	.226	.537	.940	1.432	2.015	2.684	3.445	4.295
$\frac{5}{16}$	.269	.626	1.074	1.611	2.260	2.953	3.758	4.653
$\frac{3}{8}$	.311	.714	1.206	1.790	2.459	3.219	4.069	5.009
$\frac{7}{16}$	.357	.805	1.342	1.981	2.684	3.489	4.384	5.369
$\frac{1}{2}$	.403	.895	1.478	2.148	2.908	3.758	4.698	5.727
$\frac{9}{16}$	.447	.985	1.623	2.327	3.132	4.027	5.012	6.085
$\frac{5}{8}$	.492	1.076	1.745	2.506	3.356	4.295	5.324	6.445
$\frac{11}{16}$	.537	1.176	1.880	2.684	3.579	4.564	5.637	6.801
$\frac{3}{4}$	.584	1.253	2.013	2.863	3.803	4.832	5.953	7.179
$\frac{13}{16}$	.638	1.342	2.147	3.042	4.027	5.100	6.264	7.616
$\frac{7}{8}$	.669	1.430	2.280	3.219	4.248	5.369	6.595	7.922
$\frac{15}{16}$	.704	1.509	2.404	3.388	4.462	5.625	6.888	8.227
1	.761	1.611	2.550	3.579	4.700	5.926	7.253	8.590
$1\frac{1}{8}$	.850	1.790	2.819	3.939	5.165	6.493	7.830	9.308
$1\frac{1}{4}$	.940	1.969	3.089	4.315	5.643	6.980	8.458	10.022
$1\frac{3}{8}$	1.029	2.150	3.376	4.703	6.040	7.519	9.082	10.738
$1\frac{1}{2}$	1.121	2.347	3.674	5.011	6.489	8.053	9.709	11.454
$1\frac{5}{8}$	1.226	2.554	3.890	5.369	6.933	8.588	10.333	12.168
$1\frac{3}{4}$	1.327	2.664	4.143	5.706	7.362	9.107	10.942	12.865
$1\frac{7}{8}$	1.337	2.815	4.379	6.035	7.780	9.614	11.538	13.553
2	1.478	3.042	4.698	6.443	8.277	10.201	12.216	14.317
$2\frac{1}{4}$	1.655	3.400	5.235	7.159	9.174	11.276	13.467	15.749
$2\frac{1}{2}$	1.833	3.758	5.774	7.874	10.067	12.349	14.722	17.181
$2\frac{3}{4}$	2.015	4.116	6.309	8.590	10.964	13.422	15.973	18.812
3	2.192	4.474	6.847	9.306	11.856	14.696	17.425	20.044

Lead Pipes.—The Weight of a Lineal Foot.

Bore in inches.	Thickness of Metal in parts of an inch.					
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
$\frac{3}{16}$	.243	.607	1.092	1.699	2.427	3.277
$\frac{1}{4}$	.303	.728	1.273	1.942	2.730	3.641
$\frac{5}{16}$	.364	.850	1.456	2.184	3.034	4.004
$\frac{3}{8}$	.425	.971	1.638	2.427	3.337	4.369
$\frac{7}{16}$	.485	1.092	1.820	2.670	3.640	4.733
$\frac{1}{2}$	.546	1.214	2.013	2.913	3.944	5.097
$\frac{9}{16}$	.607	1.335	2.184	3.155	4.248	5.460
$\frac{5}{8}$	.667	1.520	2.366	3.398	4.551	5.825
$\frac{11}{16}$	.728	1.578	2.548	3.641	4.853	6.189
$\frac{3}{4}$	.789	1.699	2.731	3.873	5.157	6.553
$\frac{13}{16}$	.851	1.820	2.913	4.126	5.461	6.917
$\frac{7}{8}$	.910	1.942	3.095	4.368	5.764	7.281
$\frac{15}{16}$	.971	2.063	3.276	4.611	6.067	7.646
1	1.032	2.184	3.457	4.854	6.371	8.009
$1\frac{1}{4}$	1.274	2.670	4.186	5.825	7.585	9.466
$1\frac{1}{2}$	1.517	3.155	4.915	6.796	8.796	10.923
$1\frac{3}{4}$	1.760	3.641	5.642	7.768	10.013	12.375
2	2.001	4.127	6.372	8.734	11.223	13.833
$2\frac{1}{4}$	2.245	4.607	7.096	9.707	12.436	15.290
$2\frac{1}{2}$	2.489	5.100	7.829	10.683	13.654	16.762
$2\frac{3}{4}$	2.729	5.583	8.554	11.650	14.869	18.204
3	2.971	6.066	9.286	12.492	16.080	19.660

Lead Pipes.—The Sizes and Weights usually Manufactured.

Bore in inches.	Length in feet.	The Weight of each Length in lbs.		
		Common.	Middling.	Strong.
½	15	16	22	26
¾	15	24	28	36
1	15	30	40	46
1¼	12	36	44	53
1½	12	48	56	70
2	10	56	70	83
2½	10	70	86	100

Cast Iron Balls.—The Weight of each.

Diameter in inches.	Weight in pounds.	Diameter in inches.	Weight in pounds.	Diameter in inches.	Weight in pounds.
½	.017	4½	12.42	8½	83.73
1	.136	5	17.04	9	99.40
1½	.461	5½	22.68	9½	116.90
2	1.09	6	29.45	10	136.35
2½	2.13	6½	37.44	10½	157.84
3	3.68	7	46.76	11	181.48
3½	5.84	7½	57.52	11½	207.37
4	8.73	8	69.81	12	235.65

Tin Plates.—The Weight of a Box.

Brand Mark.	No. of Sheets per Box	Size.			Weight per Box.
		in.		in.	lbs.
1 C or 1 Com.	225	$13\frac{3}{4}$	by	10	112
2 C...............	,,	$13\frac{1}{4}$	,,	$9\frac{3}{4}$	105
3 C...............	,,	$12\frac{3}{4}$	,,	$9\frac{1}{2}$	98
H C	,,	$13\frac{3}{4}$	,,	10	119
H X	,,	$13\frac{3}{4}$	,,	10	147
1 X	,,	$13\frac{3}{4}$	,,	10	140
2 X	,,	$13\frac{1}{4}$	,,	$9\frac{3}{4}$	133
3 X	,,	$12\frac{3}{4}$	,,	$9\frac{1}{2}$	126
1 XX............	,,	$13\frac{3}{4}$	,,	10	161
1 XXX.........	,,	$13\frac{3}{4}$	,,	10	182
1 XXXX	,,	$13\frac{3}{4}$	,,	10	203
D C	100	$16\frac{3}{4}$	,,	$12\frac{1}{2}$	105
D X	,,	$16\frac{3}{4}$	,,	$12\frac{1}{2}$	126
D XX	,,	$16\frac{3}{4}$	,,	$12\frac{1}{2}$	147
D XXX.........	,,	$16\frac{3}{4}$	,,	$12\frac{1}{2}$	168
D XXXX	,,	$16\frac{3}{4}$	,,	$12\frac{1}{2}$	189
S D C...........	200	15	,,	11	168
S D X	,,	15	,,	11	189
S D XX.........	,,	15	,,	11	210
S D XXX......	,,	15	,,	11	231
S D XXXX ...	,,	15	,,	11	252
Wasters....... .	225	$13\frac{3}{4}$	,,	10	126
TT	450	$13\frac{3}{4}$	,,	10	112
X TT...........	450	$13\frac{3}{4}$	,,	10	126

Round and Flat Iron Wire Ropes.

The Weight of a Fathom.

Round.				Flat.	
Circumference in inches.	Weight per fathom. lbs.	Circumference in inches.	Weight per fathom, lbs.	Size in inches.	Weight per fathom. lbs.
1	1	$3\frac{1}{4}$	$8\frac{1}{2}$	$1\frac{7}{8} \times \frac{1}{2}$	8
$1\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{3}{8}$	9	$2\frac{1}{4} \times \frac{1}{2}$	11
$1\frac{5}{8}$	2	$3\frac{1}{2}$	10	$2\frac{1}{2} \times \frac{1}{2}$	13
$1\frac{3}{4}$	$2\frac{1}{2}$	$3\frac{5}{8}$	11	$2\frac{3}{4} \times \frac{5}{8}$	15
$1\frac{7}{8}$	3	$3\frac{3}{4}$	12	$3 \times \frac{5}{8}$	16
2	$3\frac{1}{2}$	$3\frac{7}{8}$	13	$3\frac{1}{4} \times \frac{5}{8}$	18
$2\frac{1}{8}$	4	4	14	$3\frac{1}{2} \times \frac{5}{8}$	20
$2\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{1}{4}$	15	$3\frac{3}{4} \times \frac{11}{16}$	22
$2\frac{3}{8}$	5	$4\frac{3}{8}$	16	$4 \times \frac{11}{16}$	25
$2\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	$17\frac{1}{2}$	$4\frac{1}{4} \times \frac{3}{4}$	28
$2\frac{5}{8}$	6	$4\frac{5}{8}$	19	$4\frac{1}{2} \times \frac{3}{4}$	32
$2\frac{3}{4}$	$6\frac{1}{2}$	$4\frac{3}{4}$	20	$4\frac{5}{8} \times \frac{3}{4}$	34
$2\frac{7}{8}$	7	5	22	—	—
3	$7\frac{1}{2}$	$5\frac{1}{2}$	27	—	—
$3\frac{1}{8}$	8	6	32	—	—

Hemp Ropes.—The Weight per Fathom.

Cable Laid, Tarred.		Hawser Laid, Tarred.			Hawser Laid, 3 Strand White.	
Cir. in inches.	Weight per fathom lbs.	Cir. in inches.	No. of Strands.	Weight per fathom. lbs.	Cir. in inches.	Weight per fathom. lbs.
3	1.86	1	3	.23	3	1.76
3½	2.53	1½	,,	.52	3½	2.27
4	3.31	2	,,	.92	4	3.18
4½	4.18	2½	,,	1.43	4½	4.24
5	5.17	3	,,	2.06	5	5.10
5½	6.25	3½	,,	2.80	5½	6.37
6	7.44	4	,,	3.67	6	7.78
6½	8.30	4	4	3.83	6½	8.84
7	10.12	4½	3	4.64	7	10.61
7½	11.57	4½	4	4.83	7½	12.03
8	12.83	5	3	5.73	8	13.81
8½	15.68	5	4	5.82	8½	15.57
9	17.10	5½	3	6.93	9	17.34
9½	18.53	5½	4	7.09	9½	19.56
10	19.96	6	3	8.25	10	21.59
10½	22.52	6	4	8.39		
11	24.98	6½	3	9.50		
11½	27.02	6½	4	9.70		
12	29.73	7	3	11.23		
12½	31.93	7	4	11.61		
13	34.90	8	3	14.67		
13½	37.25	8	4	15.45		
14	40.47	8½	3	16.56		
14½	42.98	8½	4	17.39		
15	46.46	9	3	18.57		
16	52.86	9	4	19.37		
17	59.68	9½	,,	21.27		
18	66.90	10	,,	23.84		
19	74.55	11	,,	28.00		

Rule to find the weight.
C = Circumference of rope in inches.
W = Weight in lbs. per fath.
A = 207 for Cables.
= .242 Hawser, 4 Strand.
= .238 Ditto, 3 Strand.
= .216 Ditto, White.
$W = A \times C^2$

Wire.—The Weight of 100 Lineal Feet.

B. W. Gauge.	Diameter in Dec. of an inch.	Iron.	Steel.	Brass.	Copper.
		lbs.	lbs.	lbs.	lbs.
0	.340	30.582	30.919	33.427	35.170
1	.312	25.753	26.036	28.148	29.616
2	.284	21.338	21.573	23.322	24.539
3	.261	18.022	18.220	19.698	20.725
4	.239	15.112	15.278	16.517	17.378
5	.217	12.458	12.595	13.616	14.326
6	.208	11.446	11.572	12.510	13.163
7	.187	9.251	9.353	10.112	10.639
8	.166	7.290	7.370	7.968	8.384
9	.158	6.604	6.677	7.219	7.595
10	.137	4.965	5.020	5.427	5.710
11	.125	4.134	4.179	4.518	4.754
12	.109	3.143	3.178	3.435	3.615
13	.094	2.338	2.363	2.555	2.688
14	.080	1.693	1.712	1.851	1.947
15	.072	1.371	1.387	1.499	1.577
16	.063	1.050	1.062	1.148	1.208
17	.055	.8003	.8091	.8747	.9203
18	.048	.6095	.6162	.6662	.7010
19	.042	.4667	.4718	.5101	.5367
20	.035	.3241	.3276	.3443	.3727
21	.033	.2881	.2913	.3149	.3313
22	.029	.2225	.2249	.2432	.2559
23	.028	.2074	.2097	.2267	.2385
24	.025	.1643	.1662	.1796	.1890
25	.021	.1167	.1180	.1275	.1342
26	.020	.1058	.1070	.1157	.1217
27	.018	.0857	.0867	.0937	.0986
28	.015	.0595	.0602	.0651	.0685
29	.013	.0447	.0452	.0487	.0514
30	.012	.0381	.0385	.0416	.0438
31	.010	.0265	.0267	.0288	.0304
32	.009	.0214	.0217	.0234	.0246
33	.008	.0169	.0171	.0185	.0195
34	.007	.0130	.0131	.0142	.0149
35	.005	.0066	.0067	.0072	.0076
36	.004	.0042	.0043	.0046	.0049

Slates.

The weight of a superficial foot.

Description.	Thickness in inches.															
	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3
	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Welsh	1.88	3.75	5.63	7.50	9.38	11.25	13.13	15.00	18.75	22.50	26.25	30.00	33.75	37.50	41.25	45.00
Westmoreland	1.82	3.65	5.47	7.29	9.11	10.94	12.76	14.58	18.23	21.88	25.52	29.17	32.81	36.46	40.10	43.75
Cornish	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00

The number of superficial feet in a ton.

Description.	Thickness in inches.															
	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3
Welsh	1195	597	398	299	239	199	171	149	119	100	85	75	66	60	54	50
Westmoreland	1229	614	410	307	246	205	177	154	123	102	88	77	68	61	56	51
Cornish	1344	672	448	336	269	224	192	168	134	112	96	84	75	67	61	56

Slates.—Weight per Thousand (1200).

Description.	Size.	Penrhyn or Bangor.		Port Madoc.	
		1st Quality	2nd Quality	1st Quality	2nd Quality
	in. in.	cwts.	cwts.	cwts.	cwts.
Princesses	24 × 14	—	—	66.5	76
Duchesses	24 × 12	57	77	57	66.5
Marchionesses.	22 × 12	52.5	66.5	52.5	62
Countesses ...	20 × 10	38	50	38	47.5
Viscountesses.	18 × 10	34	44.5	33	43
Ditto	18 × 9	—	—	28.5	38
Ladies	16 × 10	29.5	40	28.5	36
Ditto	16 × 8	23.5	31.5	22.5	27.5
Ditto	15 × 8	25	33	—	—
Ditto	14 × 12	31.5	42	31	38
Ditto	14 × 8	21	25.5	21	23.5
Plantations ...	13 × 10	23.5	29.5	25	—
Doubles.........	13 × 6	15	18	—	—
Ditto	12 × 8	$17\frac{1}{2}$	21	—	—

Corrugated Iron Roofing.

B. W. Gauge.	Size of Sheets.	Weight per Square.	No. of sup. feet per ton.
	ft. ft. ft. ft.	cwts.	
16	6 × 2 to 8 × 3	$3\frac{1}{8}$	800
18	6 × 2 ,, 8 × 3	$2\frac{1}{4}$	1000
20	6 × 2 ,, 8 × 3	$1\frac{3}{4}$	1250
22	6 × 2 ,, 7 × $2\frac{1}{2}$	$1\frac{1}{2}$	1550
24	6 × 2 ,, 7 × $2\frac{1}{2}$	$1\frac{1}{4}$	1880
26	6 × 2 ,, 7 × $2\frac{1}{2}$	1	2170

STONE.

THE QUANTITY EQUAL TO A TON IN WEIGHT.

	Cubic feet		Sup. feet.
Vein marble	13	2 in. York paving,	86
Statuary ditto ...	13½	2½ ,, ditto	70
Granite	13½	3 ,, ditto	57½
Kentish rag	13½	4 ,, York landing,	43
Purbeck	13¾	6 ,, ditto	28½
Yorkshire	14½	2 ,, Purbeck paving	83
Blue lias limestone	14½	2½ ,, ditto	66¼
Portland	14¾	3 ,, ditto	55¼
Cragleith	14¾	3 ,, Granite	54
Bath	16	4 ,, ditto	39
Caen	17	6 ,, ditto	27

THE WEIGHT OF LIMES AND CEMENTS.

Description.	Weight per bushel.	Weight per cubic foot.
In the Stone.	lbs.	lbs.
Plymouth stone lime	70	54½
Keynsham blue lias	80	62¼
Lyme Regis ditto	75	58½
Ground.		
Keynsham blue lias	63	49
Lyme Regis ditto	70	54½
Roman cement	77	60
Portland cement	100	78

Yorkshire Paving.—Weight per Foot Sup.

Thickness in inches.	Weight in lbs.	Thickness in inches.	Weight in lbs.
2	26	4	52
$2\frac{1}{2}$	26.5	$4\frac{1}{2}$	58.5
3	39	5	65
$3\frac{1}{2}$	45.5	6	78

Purbeck Paving.—Weight per Foot Sup.

Thickness in inches.	Weight in lbs.	Thickness in inches.	Weight in lbs.
2	27	4	54
$2\frac{1}{2}$	33.75	$4\frac{1}{2}$	60.75
3	40.5	5	67.5
$3\frac{1}{2}$	47.25	6	81.

Marble Slabs.—Weight per Foot Sup.

Thickness in inches.	Weight in lbs.	Thickness in inches.	Weight in lbs.
$\frac{1}{2}$	7.17	$1\frac{1}{2}$	21.5
$\frac{3}{4}$	10.75	$1\frac{3}{4}$	25.08
1	14.33	2	28.67
$1\frac{1}{4}$	17.92	$2\frac{1}{2}$	35.83

Bricks and Tiles.—Weight per Thousand.

Description.	Size.	Weight of each.	Weight per 1000.
Bricks.	in. in. in.	lbs.	cwts.
London stocks ...	$8\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{3}{4}$	6.81	$60\frac{3}{4}$
Red kiln	,,	7.00	63
Welsh fire.........	$9 \times 4\frac{1}{2} \times 2\frac{3}{4}$	7.84	65
Paving	$9 \times 4\frac{1}{2} \times 1\frac{3}{4}$	5.00	45
Dutch clinkers...	$6\frac{1}{4} \times 3 \times 1\frac{1}{2}$	1.55	14
Roofing Tiles.			
Plain	$10\frac{1}{2} \times 6\frac{1}{2} \times \frac{5}{8}$	2.51	$22\frac{1}{4}$
Ditto	$11 \times 7 \times \frac{5}{8}$	2.90	$26\frac{1}{4}$
Pan	$13\frac{1}{2} \times 9\frac{1}{2} \times \frac{1}{2}$	5.25	47
Paving Tiles.			
Squares	$6 \times 6 \times 1$	2.16	$19\frac{1}{4}$
Ditto	$9\frac{3}{4} \times 9\frac{3}{4} \times 1$	5.70	50
Ditto	$11\frac{3}{4} \times 11\frac{3}{4} \times 1\frac{1}{2}$	12.42	111
Hexagons	$6 \times 6 \times \frac{7}{8}$	1.63	$14\frac{1}{2}$
Ditto	$6 \times 6 \times 1$	1.86	$16\frac{1}{2}$

Fire-Clay Flue Linings—18-in. long.

Circular, 12-inches diam., weigh each 50 lbs.

Elliptical, 14 in. × 9 in., ,, 45 ,,

Square, 11 in. × 11 in., ,, 46 ,,

The Weight of Ridge Tiles.

Description.	Length.		Breadth of Wings.		Weight per hundred.	
	ft.	in.	ft.	in.	cwts.	qrs.
Plain	1	6	0	6	10	0
,, ...	1	6	0	7	14	0
Rolled top ...	1	6	0	6	12	2
,, ...	1	6	0	7	18	0
Rolled capped	1	6	0	7	18	0
Capped	1	6	0	6	12	0
,, ...	1	6	0	7	15	0
,, angular	1	6	0	7	17	0
,, short ...	1	0	0	7	10	0
Pyramid	1	6	0	7	20	0

The Weight of Men and Horses.

A crowd of men closely packed = 84 lbs. per foot superficial.

A horse (cavalry) .... = 11 cwt.
,, (strong for carting) .... = 18 ,,

The Weight of Forage.

Hay, as usually delivered ...5 lbs. per cub. foot
,, well pressed ....8 lbs. ,,
Straw, as usually delivered...3½ lbs. ,,
,, well pressed ....5⅓ lbs. ,,
Oats (new) ....3.64 cub. ft. per cwt.
Barley (new) ....2.38 ,, ,,
Wheat (new) ....2.20 ,, ,,
Ditto (kiln dried) ....2.36 ,, ,,

Earth, &c.

The quantity equal to a ton in weight (average).

Chalk	14	cubic feet
Clay	18	,,
Earth	21	,,
Thames ballast	20	,,
Gravel, coarse	19	,,
Sand, pit	22	,,
Ditto, river	19	,,
Marl	18	,,
Shingle	23	,,
Night soil	18	,,

Water.

1 cubic inch	= .0361	lbs.
1 gallon	= 10.0000	,,
1 cubic foot	= 62.3210	,,
1 ditto	= 6.2321	gallons
35.943 cubic feet	= 1	ton

Approximately 1 cubic foot = $6\frac{1}{4}$ gallons.

The Weight of Coal

As used in Commerce, per cubic foot.

Welsh anthracite	= 58.25	lbs.
,, bituminous	= 53.00	,,
Lancashire	= 50.00	,,
Newcastle	= 50.00	,,
Scotch	= 53.00	,,

Space occupied by a ton.

Welsh anthracite	= 39	cub. ft.
,, bituminous	= 43	,,
Lancashire	= 44	,,
Newcastle	= 45	,,
Scotch	= 43	,,

The navy allowance for stowage = 48 cub. ft.

The Weight of Various Substances.

Metals.

Description.	Weight per cubic ft. in lbs.
Aluminium	162
Antimony, cast	419
Bismuth, cast	614
Brass, cast	525
„ wire	534
Bronze	513
Copper, cast	550
„ sheet and wire	555
Gold, pure	1210
„ standard	1108
Gun metal	549
Iron, wrought	485
„ cast	450
Lead, milled	712
„ cast	710
Mercury, fluid	848
„ solid	977
Nickel, cast	788
Platinum, pure	1220
„ wire drawn	1300
„ hammered	1280
Pewter	453
Silver, pure	655
„ standard	658
Steel	490
Tin, cast	456
Type-metal	653
Zinc	450

THE WEIGHT OF VARIOUS SUBSTANCES, *continued.*

STONES, EARTHS, &c.

Description.	Weight per cubic ft. in lbs.
Asphaltum	56
Basalt	182
Bath stone	156
Bees wax	60
Bitumen	69
Brick, common London stock	115
„ red facing	118
„ fire	122
Brickwork, in mortar	100
" in cement	110
Caen stone	132
Cement, Portland	80
„ Roman	65
„ „ and sand equal parts	112
Chalk	160
Charcoal, from birch	34
„ „ fir	28
„ „ oak	21
„ „ pine	18
Clay, potters	120
„ with gravel	130
„ ordinary	120
Coal, solid	80
Coke	47
Concrete, Portland cement	130
„ common lime	118
Emery	250
Earth, vegetable	90
„ loamy	100
„ semifluid	110
Flint	162
Freestone, hewn	140

THE WEIGHT OF VARIOUS SUBSTANCES, *continued.*

STONES, EARTHS, &c., *continued.*

Description.	Weight per cubic ft. in lbs.
Glass, white flint	188
,, plate	184
,, crown	158
Gravel, Thames	112
,, coarse, mixed with sand	120
Granite, Aberdeen grey	167
,, ,, red	165
,, Cornish	166
,, Guernsey	185
Gun powder, large grain	57
,, fine grain	56
Gutta percha	61
Gypsum, natural state	140
Ivory	114
India rubber	60
Kentish rag stone	166
Lime stone, lias	156
,, magnesian	130
,, Plymouth	167
,, compact (mountain)	170
Lime, ordinary quick (of stone)	53
,, (chalk)	45
Marble, average	170
Marl	120
Masonry, rubble	140
,, flint	148
,, ashlar, Portland	146
,, ,, Purbeck	150
,, ,, granite	160
Mortar, old	90
,, new	110
,, ,, well tempered	115
Millstone	155

THE WEIGHT OF VARIOUS SUBSTANCES, *continued.*
STONES, EARTHS, &c., *continued.*

Description.	Weight per cubic ft. in lbs.
Peat, hard	83
Pitch	72
Plaster of Paris, cast	80
Portland stone	152
Porphyry, green	180
„ red	175
Pumice stone	57
Purbeck stone	162
Puzzolana	170
Quartz	166
Rotten stone	124
Sand, river	118
„ „ Thames	103
„ pit, clean coarse	100
„ „ fine grained and clean	95
Sand stone, Craigleith	152
Shingle	95
Slate, Welsh	181
„ „ rag	172
„ Anglesey	180
„ Westmoreland pale blue	175
„ „ dark blue	174
„ „ greenish	173
„ Cornish grey blue	160
Sulphur, melted	124
„ native	127
Syenite, Mount Sorrel	164
Tallow	59
Tar	63
Tiles, average	115
Whinstone, Scotch	172
Yorkshire paving	156

THE WEIGHT OF VARIOUS SUBSTANCES, *continued*.

TIMBER (*Seasoned*).

Description.	Weight per cubic ft. in lbs.
Apple-tree	49
Ash	50
Bay-tree	50
Beech	51
Birch	48
Box	60
Cedar, American	30
,, of Lebanon	35
Cherry-tree	42
Chesnut..	40
Cork	15
Ebony, Indian	70
,, American	80
Elder	42
Elm	39
Fir, Dantzic	35
,, Memel	38
Hazel	40
Hornbeam	48
Larch	35
Lignum-vitæ	70
Logwood	55
Mahogany, Honduras	40
,, Spanish	55
Maple	47
Oak, English	50
,, American	47
,, Baltic	46
Pine, red	40
,, yellow	33
Poplar, white Spanish	32

The Weight of Various Substances, *continued.*

Timber (*Seasoned*).

Description.	Weight per cubic ft. in lbs.
Sycamore	37
Teak, Indian	41
„ African	60
Wainscot, Riga	38
Walnut, American	35
„ Spanish	43
Willow	30
Yew	50

Liquids.

	Weight of water = 1000.	Weight per gallon in lbs.
Acid, sulphuric	1850	18.5
„ nitric	1271	12.7
„ muriatic	1200	12.0
Alcohol of commerce	825	8.2
„ proof spirit	922	9.2
Oil, linseed	940	9.4
„ whale	923	9.2
„ of turpentine	870	8.7
Naphtha	848	8.5
Petroleum	878	8.8
Tar	1015	10.1
Water from Mediterranean	1029	10.3
„ „ Irish Channel	1028	10.3
„ „ ice	1001	10.1
„ distilled	1000	10.0
Vinegar	1009	10.1

The Weight of Various Substances, *continued*.

Gases.

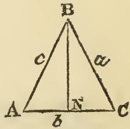
Description.	Specific gravity.
Atmospheric air, 1 cub. ft. = .075 lbs.	1.000
Chlorine	2.500
Carbonic acid and nitrous oxide	1.527
Cyanogen	1.805
Carburetted hydrogen	.972
Hydrogen	.069
Oxygen	1.100
Steam at 212°	.600
Sulphuretted hydrogen	1.770
Coal gas used in lighting	.450

To Find the Weight of Castings from that of their Patterns.

Multiply	weight of	deal pattern	by 14	for	cast iron.
Ditto	,,	,,	16	,,	brass.
Ditto	,,	,,	16.7	,,	copper.
Ditto	,,	,,	21.5	,,	lead.

MENSURATION.

TRIANGLES.



$$\text{Area} = \frac{\text{A C} \times \text{B N}}{2}$$

$$\text{Area} = \frac{\text{A B} \times \text{A C} \times \text{Sin. A}}{2}$$

If the sides A B, B C, and A C be represented by $c\ a\ b$, and *half* their sum by s, then

$$\text{Area} = \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$$

In the right angled triangle A N B, we have

$$\text{A B}^2 = \text{A N}^2 + \text{B N}^2$$

$$\text{A B} = \sqrt{\text{A N}^2 + \text{B N}^2}$$

The sides of a triangle being represented by $a\,b\,c$ as before, and the angles by A B C

$$a = \frac{b\ \text{Sin. A}}{\text{Sin. B}}$$

$$\text{Sin. A} = \frac{a\ \text{Sin. B}}{b}$$

Two sides and the included angle given, to find the other side

$$a = \sqrt{b^2 + c^2 - 2\,b\,c\ \text{Cos. A}}$$

Given three sides to find the angles.

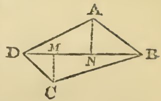
$$\text{Cos. A} = \frac{b^2 + c^2 - a^2}{2\,b\,c}$$

QUADRILATERAL OR FOUR-SIDED FIGURES.

To obtain the area of the Square, Rectangle, rhombus, or rhomboid, the opposite sides of which are parallel, multiply the length of the base by the perpendicular height.

The area of a trapeziod, two sides only being parallel, is found by multiplying the mean length of the parallel sides by the perpendicular distance between them.

The area of a Trapezium which has none of its sides parallel, is found by taking half the sum of the perpendiculars, multiplied by the diagonal on which they fall, or,



$$\text{Area} = \tfrac{1}{2}\,DB\,(AN + CM)$$

Polygons.

Irregular Polygons may be divided into triangles or trapeziums, and the areas found by the foregoing rules:—

Regular Polygons are equal in area to half the sum of the sides multiplied by the perpendicular drawn from the centre.

Regular polygons are to each other as the squares of their homologous sides, therefore, if the area of a polygon whose side equals 1 (as in col. B of table) be multiplied by the square of the side of any similar polygon, the product will be the corresponding area.

The square of the diameter of a polygon (measured from opposite sides) multiplied by the number in col. A, will give the area.

The perpendicular drawn from the centre of a polygon to its side, is equal to the side multiplied by the No. in col. D.

The radius of a circle which circumscribes a given polygon, is equal to the side multiplied by the No. in col. E.

The length of the side of a given polygon is equal to the radius of its circumscribing circle multiplied by the No. in col. F.

Table of Regular Polygons.

Number of Sides.	Name.	A Area when diameter of inscribed circle =1.	B Area when side =1.	C Length of side when perpendicular =1.	D Perpendicular when side =1.	E Radius of circumscribed circle when side =1.	F Length of side when radius of circumscribed circle =1.
3	Triangle ...	1.2990383	0.4330127	3.4641020	0.2886751	.577350	1.732051
4	Square......	1.0000000	1.0000000	2.0000000	0.5000000	.707107	1.414214
5	Pentagon...	.9081781	1.7204774	1.4530850	0.6881910	.850651	1.175570
6	Hexagon ...	.8660254	2.5980762	1.1547005	0.8660254	1.000000	1.000000
7	Heptagon...	.8427548	3.6339124	.9631483	1.0386207	1.152381	.867764
8	Octagon ...	.8284271	4.8284271	.8284271	1.2071068	1.306560	.765367
9	Nonagon ...	.8189330	6.1818242	.7279405	1.3737387	1.461902	.684040
10	Decagon ...	.8120553	7.6942088	.6496442	1.5388418	1.618034	.618034
11	Undecagon	.8074727	9.3656399	.5872529	1.7028436	1.774736	.563464
12	Dodecagon.	.8038476	11.1961524	.5358984	1.8660254	1.931850	.517638

CIRCLES.

a=Area of circle.
c=Circumference.
d=Diameter.
D=Diameter of circumscribed circle.
s=Side of square=in area to circle.
S=Side of inscribed square.

then,

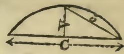
$$a=.7854d^2.$$
$$a=\frac{c\,d}{4}$$
$$c=3.1416d.$$
$$d=\ .31831c.$$
$$d=1.128379\sqrt{a}$$
$$d=\ .7071068S.$$
$$d=1.128379s.$$
$$D=1.414214S.$$
$$s=\ .8862269d.$$
$$S=\ .2250791c.$$

CIRCULAR SECTORS.

Let the diameter and radius of the circle of which the sector is a part be represented by d and r, the length of the arc and number of degrees by l and n, then

$$\text{Area}=\frac{r\,l}{2}$$
$$\text{Area}=.00218168d^2n.$$

Circular Segments.



To the square of the chord C of the segment add the square of the versed sine V, and to twice the square root of the sum add the chord of half the arc *b*. Multiply the result by the versed sine and $\frac{4}{15}$ of the product will give the area.

or,

$$\text{Area} = \frac{2}{3} C V + \frac{V^3}{2 C} \text{ nearly.}$$

Note.—When the segment is greater than a semicircular find the area of the remaining segment and deduct from the whole circle.

To find the area by the table:—

Divide the height or versed sine of the segment by the diameter of the circle of which it is a part to three places of decimals, and multiply the square of the same diameter by the number in col. A, opposite to the quotient in col. H, and the product will be the area of the segment.

Note.—If the quotient of the height by the diameter is greater than .500, substract it from 1, find the remainder in col. H, and substract the corresponding numbers in col. A from .7854, and multiply by the square of the diameter as before.

Table of the Areas of the Segments of a Circle whose Diameter equals 1.

Height. H.	Area. A.	Height. H.	Area. A.	Height. H.	Area. A.
.001	.000042	.031	.007209	.061	.019716
.002	.000119	.032	.007558	.062	.020196
.003	.000219	.033	.007913	.063	.020681
.004	.000337	.034	.008273	.064	.021168
.005	.000470	.035	.008438	.065	.021659
.006	.000618	.036	.009008	.066	.022154
.007	.000779	.037	.009383	.067	.022652
.008	.000951	.038	.009763	.068	.023154
.009	.001135	.039	.010148	.069	.023659
.010	.001329	.040	.010537	.070	.024168
.011	.001533	.041	.010931	.071	.024680
.012	.001746	.042	.011330	.072	.025195
.013	.001968	.043	.011734	.073	.025714
.014	.002199	.044	.012142	.074	.026236
.015	.002438	.045	.012554	.075	.026761
.016	.002685	.046	.012971	.076	.027289
.017	.002940	.047	.013392	.077	.027821
.018	.003202	.048	.013818	.078	.028356
.019	.003471	.049	.014247	.079	.028894
.020	.003748	.050	.014681	.080	.029435
.021	.004031	.051	.015119	.081	.029979
.022	.004322	.052	.015561	.082	.030526
.023	.004618	.053	.C16007	.083	.031076
.024	.004921	.054	.016457	.084	.031629
.025	.005230	.055	.016911	.085	.032180
.026	.005546	.056	.017369	.086	·032745
.027	.005867	.057	.017831	.087	.033307
.028	.006194	.058	.018296	.088	.033872
.029	.006527	.059	.018766	.089	.034441
.030	.006865	.060	.019239	.090	.035011

SEGMENTS OF A CIRCLE—*continued.*

Height. H.	Area. A.	Height. H.	Area. A.	Height. H.	Area. A.
.091	.035585	.122	.054689	.153	.076026
.092	.036162	.123	.055345	.154	.076747
.093	.036741	.124	.056003	.155	.077469
.094	.037323	.125	.056663	.156	.078194
.095	.037909	.126	.057326	.157	.078921
.096	.038496	.127	.057991	.158	.079649
.097	.039087	.128	.058658	.159	.080380
.098	.039680	.129	.059327	.160	.081112
.099	.040276	.130	.059999	.161	.081846
.100	.040875	.131	.060672	.162	.082582
.101	.041476	.132	.061348	.163	.083320
.102	.042080	.133	.062026	.164	.084059
.103	.042687	.134	.062707	.165	.084801
.104	.043296	.135	.063389	.166	.085544
.105	.043908	.136	.064074	.167	.086289
.106	.044522	.137	.064760	.168	.087036
.107	.045139	.138	.065449	.169	.087785
.108	.045759	.139	.066140	.170	.088535
.109	.046381	.140	.066833	.171	.089287
.110	.047005	.141	.067528	.172	.090041
.111	.047632	.142	.068225	.173	.090797
.112	.048262	.143	.068924	.174	.091554
.113	.048894	.144	.069625	.175	.092313
.114	.049528	.145	.070328	.176	.093074
.115	.050165	.146	.071033	.177	.093836
.116	.050804	.147	.071741	.178	.094601
.117	.051446	.148	.072450	.179	.095366
.118	.052090	.149	.073161	.180	.096134
.119	.052736	.150	.073874	.181	.096903
.120	.053385	.151	.074589	.182	.097674
.121	.054036	.152	.075306	.183	.098447

SEGMENTS OF A CIRCLE—*continued.*

Height. H.	Area. A.	Height. H.	Area. A.	Height. H.	Area. A.
.184	.099221	.215	.123988	.246	.150091
.185	.099997	.216	.124810	.247	.150953
.186	.100774	.217	.125634	.248	.151816
.187	.101553	.218	.126459	.249	.152680
.188	.102334	.219	.127285	.250	.153546
.189	.103116	.220	.128113	.251	.154412
.190	.103900	.221	.128942	.252	.155280
.191	.104685	.222	.129773	.253	.156149
.192	.105472	.223	.130605	.254	.157019
.193	.106261	.224	.131438	.255	.157890
.194	.107051	.225	.132272	.256	.158762
.195	.107842	.226	.133108	.257	.159636
.196	.108636	.227	.133945	.258	.160510
.197	.109430	.228	.134784	.259	.161386
.198	.110226	.229	.135624	.260	.162263
.199	.111024	.230	.136465	.261	.163140
.200	.111823	.231	.137307	.262	.164019
.201	.112624	.232	.138150	.263	.164899
.202	.113426	.233	.138995	.264	.165780
.203	.114230	.234	.139841	.265	.166663
.204	.115035	.235	.140688	.266	.167546
.205	.115842	.236	.141537	.267	.168430
.206	.116650	.237	.142387	.268	.169315
.207	.117460	.238	.143238	.269	.170202
.208	.118271	.239	.144091	.270	.171089
.209	.119083	.240	.144944	.271	.171978
.210	.119897	.241	.145799	.272	.172867
.211	.120712	.242	.146655	.273	.173758
.212	.121529	.243	.147512	.274	.174649
.213	.122347	.244	.148371	.275	.175542
.214	.123167	.245	.149230	.276	.176435

Height. H.	Area. A.	Height H.	Area. A.	Height. H.	Area. A.
.277	.177330	.308	.205527	.339	.234526
.278	.178225	.309	.206451	.340	.235473
.279	.179122	.310	.207376	.341	.236421
.280	.180019	.311	.208301	.342	.237369
.281	.180918	.312	.209227	.343	.238318
.282	.181817	.313	.210154	.344	.239268
.283	.182718	.314	.211082	.345	.240218
.284	.183619	.315	.212011	.346	.241169
.285	.184521	.316	.212940	.347	.242121
.286	.185425	.317	.213871	.348	.243074
.287	.186329	.318	.214802	.349	.244026
.288	.187234	.319	.215733	.350	.244980
.289	.188140	.320	.216666	.351	.245934
.290	.189047	.321	.217599	.352	.246889
.291	.189955	.322	.218533	.353	.247845
.292	.190864	.323	.219468	.354	.248801
.293	.191775	.324	.220404	.355	.249757
.294	.192684	.325	.221340	.356	.250715
.295	.193596	.326	.222277	.357	.251673
.296	.194509	.327	.223215	.358	.252631
.297	.195422	.328	.224154	.359	.253590
.298	.196337	.329	.225093	.360	.254550
.299	.197252	.330	.226033	.361	.255510
.300	.198168	.331	.226974	.362	.256471
.301	.199085	.332	.227915	.363	.257433
.302	.200003	.333	.228858	.364	.258395
.303	.200922	.334	.229801	.365	.259357
.304	.201841	.335	.230745	.366	.260320
.305	.202761	.336	.231689	.367	.261284
.306	.203683	.337	.232634	.368	.262248
.307	.204605	.338	.233580	.369	.263213

SEGMENTS OF A CIRCLE—*continued.*

Height. H.	Area. A.	Height. H.	Area. A.	Height. H,	Area. A.
.370	.264178	.401	.294349	.432	.324909
.371	.265144	.402	.295330	.433	.325900
.372	.266111	.403	.296311	.434	.326892
.373	.267078	.404	.297292	.435	.327882
.374	.268045	.405	.298273	.436	.328874
.375	.269013	.406	.299255	.437	.329866
.376	.269982	.407	.300283	.438	.330858
.377	.270951	.408	.301220	.439	.331850
.378	.271920	.409	.302203	.440	.332843
.379	.272890	.410	.303187	.441	.333836
.380	.273861	.411	.304171	.442	.334829
.381	.274832	.412	.305155	.443	.335822
.382	.275803	.413	.306140	.444	.336816
.383	.276775	.414	.307125	.445	.337810
.384	.277748	.415	.308110	.446	.338804
.385	.278721	.416	.309095	.447	.339798
.386	.279694	.417	.310081	.448	.340793
.387	.280668	.418	.311068	.449	.341787
.388	.281642	.419	.312054	.450	.342782
.389	.282617	.420	.313041	.451	.343777
.390	.283592	.421	.314029	.452	.344772
.391	.284568	.422	.315016	.453	.345768
.392	.285544	.423	.316004	.454	.346764
.393	.286521	.424	.316992	.455	.347759
.394	.287498	.425	.317981	.456	.348755
.395	.288476	.426	.318970	.457	.349752
.396	.289453	.427	.319959	.458	.350748
.397	.290432	.428	.320948	.459	.351745
.398	.291411	.429	.321938	.460	.352742
.399	.292390	.430	.322928	.461	.353739
.400	.293369	.431	.323918	.462	.354736

Height. H.	Area. A.	Height. H.	Area. A.	Height. H.	Area. A.
.463	.355732	.476	.368708	.489	.381699
.464	.356730	.477	.369707	.490	.382699
.465	.357727	.478	.370706	.491	.383699
.466	.358725	.479	.371705	.492	.384699
.467	.359723	.480	.372764	.493	.385699
.468	.360721	.481	.373703	.494	.386699
.469	.361719	.482	.374702	.495	.387699
.470	.362717	.483	.375702	.496	.388699
.471	.363715	.484	.376702	.497	.389699
.472	.364713	.485	.377701	.498	.390699
.473	.365712	.486	.378701	.499	.391699
.474	.366710	.487	.379700	.500	.392699
.475	.367709	.488	.380700		

CIRCULAR RING.

Let D equal the external diameter, and *d* equal the internal diameter, then

$$\text{Area} = .7854\ (D^2 - d^2).$$

PROPERTIES OF A CIRCLE.

A circle is equal to a triangle whose base and altitude are equal to the circumference and radius.

The LENGTH of any arc of a circle equals the number of degrees in the arc multiplied by the radius of the circle, and by .01745329,

or

It equals *one third* of the difference between *eight* times the chord of *half* the arc, and the chord of the whole arc nearly—or

Divide the height by the chord and the number opposite to the quotient in the following table multiplied by the same chord will equal the length of the arc:—

TABLE OF THE LENGTH OF CIRCULAR ARCS.
CHORD = 1.

Height.	Length.	Height,	Length.	Height.	Length.
.100	1.02645	.126	1.04181	.152	1.06051
.101	1.02698	.127	1.04247	.153	1.06130
.102	1.02752	.128	1.04313	.154	1.06209
.103	1.02806	.129	1.04380	.155	1.06288
.104	1.02860	.130	1.04447	.156	1.06368
.105	1.02914	.131	1.04515	.157	1.06449
.106	1.02970	.132	1.04584	.158	1.06530
.107	1.03026	.133	1.04652	.159	1.06611
.108	1.03082	.134	1.04722	.160	1.06693
.109	1.03139	.135	1.04792	.161	1.06775
.110	1.03196	.136	1.04862	.162	1.06858
.111	1.03254	.137	1.04932	.163	1.06941
.112	1.03312	.138	1.05003	.164	1.07025
.113	1.03371	.139	1.05075	.165	1.07109
.114	1.03430	.140	1.05147	.166	1.07194
.115	1.03490	.141	1.05220	.167	1.07279
.116	1.03551	.142	1.05293	.168	1.07365
.117	1.03611	.143	1.05367	.169	1.07451
.118	1.03672	.144	1.05441	.170	1.07537
.119	1.03734	.145	1.05516	.171	1.07624
.120	1.03797	.146	1.05591	.172	1.07711
.121	1.03860	.147	1.05667	.173	1.07799
.122	1.03923	.148	1.05743	.174	1.07888
.123	1.03987	.149	1.05819	.175	1.07977
.124	1.04051	.150	1.05896	.176	1.08066
.125	1.04116	.151	1.05973	.177	1.08156

CIRCULAR ARCS—*continued.*

Height.	Length.	Height.	Length.	Height.	Length.
.178	1.08246	.209	1.11269	.240	1.14714
.179	1.08337	.210	1.11374	.241	1.14831
.180	1.08428	.211	1.11479	.242	1.14949
.181	1.08519	.212	1.11584	.143	1.15067
.182	1.08611	.213	1.11692	.144	1.15186
.183	1.08704	.214	1.11796	.145	1.15308
.184	1.08797	.215	1.11904	.246	1.15429
.185	1.08890	.216	1.12011	.247	1.15549
.186	1.08984	.217	1.12118	.248	1.15670
.187	1.09079	.218	1.12225	.249	1.15791
.188	1.09174	.219	1.12334	.250	1.15912
.189	1.09269	.220	1.12445	.251	1.16033
.190	1.09365	.221	1.12556	.252	1.16157
.191	1.09461	.222	1.12663	.253	1.16279
.192	1.09557	.223	1.12774	.254	1.16402
.193	1.09654	.224	1.12885	.255	1.16526
.194	1.09752	.225	1.12997	.256	1.16649
.195	1.09850	.226	1.13108	.257	1.16774
.196	1.09949	.227	1.13219	.258	1.16899
.197	1.10048	.228	1.13331	.259	1.17024
.198	1.10147	.229	1.13444	.260	1.17150
.199	1.10247	.230	1.13557	.261	1.17275
.200	1.10348	.231	1.13671	.262	1.17401
.201	1.10447	.232	1.13786	.263	1.17527
.202	1.10548	.233	1.13903	.264	1.17655
.203	1.10650	.234	1.14020	.265	1.17784
.204	1.10752	.235	1.14136	.266	1.17912
.205	1.10855	.236	1.14247	.267	1.18040
.206	1.10958	.237	1.14363	.268	1.18162
.207	1.11062	.238	1.14480	.269	1.18294
.208	1.11165	.239	1.14597	.270	1.18428

Circular Arcs—*continued.*

Height,	Length.	Height.	Length.	Height.	Length.
.271	1.18557	.302	1.22776	.333	1.27349
.272	1.18688	.303	1.22918	.334	1.27502
.273	1.18819	.304	1.23061	.335	1.27656
.274	1.18969	.305	1.23205	.336	1.27810
.275	1.19082	.306	1.23349	.337	1.27864
.276	1.19214	.307	1.23494	.338	1.28118
.277	1.19345	.308	1.23636	.339	1.28273
.278	1.19477	.309	1.27780	.340	1.28428
.279	1.19610	.310	1.23925	.341	1.28583
.280	1.19743	.311	1.24070	.342	1.28739
.281	1.19887	.312	1.24216	.343	1.28895
.282	1.20011	.313	1.24360	.344	1.29052
.283	1.20146	.314	1.24506	.345	1.29209
.284	1.20282	.315	1.24654	.346	1.29366
.285	1.20419	.316	1.24801	.347	1.29523
.286	1.20558	.317	1.24946	.348	1.29681
.287	1.20696	.318	1.25095	.349	1.29839
.288	1.20828	.319	1.25243	.350	1.29997
.289	1.20967	.320	1.25391	.351	1.30156
.290	1.21202	.321	1.25539	.352	1.30315
.291	1.21239	.322	1.25686	.353	1.30474
.292	1.21381	.323	1.25836	.354	1.30634
.293	1.21520	.324	1.25987	.355	1.30794
.294	1.21658	.325	1.26137	.356	1.30954
.295	1.21794	.326	1.26286	.357	1.31115
.296	1.21926	.327	1.26437	.358	1.31276
.297	1.22061	.328	1.26588	.359	1.31437
.298	1.22203	.329	1.26740	.360	1.31599
.299	1.22347	.330	1.26892	.361	1.31761
.300	1.22495	.331	1.27044	.362	1.31923
.301	1.22635	.332	1.27196	.363	1.32086

Height.	Length.	Height.	Length.	Height.	Length.
.364	1.32249	.395	1.37455	.426	1.42945
.365	1.32413	.396	1.37628	.427	1.43127
.366	1.32577	.397	1.37801	.428	1.43309
.367	1.32741	.398	1.37974	.429	1.43491
.368	1.32905	.399	1.38148	.430	1.43673
.369	1.33069	.400	1.38322	.431	1.43856
.370	1.33234	.401	1.38496	.432	1.44039
.371	1.33399	.402	1.38671	.433	1.44222
.372	1.33564	.403	1.38846	.434	1.44405
.373	1.33730	.404	1.39021	.435	1.44589
.374	1.33896	.405	1.39196	.436	1.44773
.375	1.34063	.406	1.39372	.437	1.44957
.376	1.34229	.407	1.39548	.438	1.45142
.377	1.34396	.408	1.39724	.439	1.45327
.378	1.34563	.409	1.39900	.440	1.45512
.379	1.34731	.410	1.40077	.441	1.45697
.380	1.34899	.411	1.40254	.442	1.45883
.381	1.35068	.412	1.40432	.443	1.46069
.382	1.35237	.413	1.40610	.444	1.46255
.383	1.35406	.414	1.40788	.445	1.46441
.384	1.35575	.415	1.40966	.446	1.46628
.385	1.35744	.416	1.41145	.447	1.46815
.386	1.35914	.417	1.41324	.448	1.47002
.387	1.36084	.418	1.41503	.449	1.47189
.388	1.36254	.419	1.41682	.450	1.47377
.389	1.36425	.420	1.41861	.451	1.47565
.390	1.36596	.421	1.42041	.452	1.47753
.391	1.36767	.422	1.42222	.453	1.47942
.392	1.36939	.423	1.42402	.454	1.48131
.393	1.37111	.424	1.42583	.455	1.48320
.394	1.37283	.425	1.42764	.456	1.48509

Circular Arcs—*continued.*

Height.	Length.	Height.	Length.	Height.	Length.
.457	1.48699	.472	1.51571	.487	1.54499
.458	1.48889	.473	1.51764	.488	1.54696
.459	1.49079	.474	1.51958	.489	1.54893
.460	1.49269	.475	1.52152	.490	1.55090
.461	1.49460	.476	1.52346	.491	1.55288
.462	1.49651	.477	1.52541	.492	1.55486
.463	1.49842	.478	1.52736	.493	1.55685
.464	1.50033	.479	1.52931	.494	1.55854
.465	1.50224	.480	1.53126	.495	1.56083
.466	1.50416	.481	1.53322	.496	1.56282
.467	1.50608	.482	1.53518	.497	1.56481
.468	1.50800	.483	1.53714	.498	1.56680
.469	1.50992	.484	1.53910	.499	1.56879
.470	1.51185	.485	1.54106	.500	1.57079
.471	1.51378	.486	1.54302		

The RADIUS of any Segment of a Circle being represented by R, the versed sine or height by v, and half the chord c by s, we have

$$R = \frac{s^2 + v^2}{2\,v}$$

$$v = R - \sqrt{R^2 - s^2}$$

In an arc of 120° *we have*

Radius O A = .57735 A B

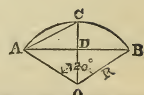
" O A = A C

Arc A C B = 1.209198 A B

" A C B = 2.09439 R

C D = D O

C D = Rad.

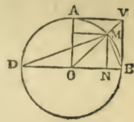


$$A\,B = R\sqrt{3} = 1.7320508\ R$$

Area of 120° segment = .6141874 R^2

" " segment = .2047291 $A\,B^2$

" " sector... = 1.0472 R^2



$$D\,B = \frac{M\,B^2}{N\,B}$$

$$N\,B = \frac{M\,N^2}{D\,N}$$

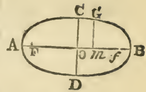
$$D\,N = \frac{M\,N^2}{N\,B}$$

$$D\,M = \sqrt{D\,N \times N\,B}$$

$$M\,B = \sqrt{N\,B \times D\,B}$$

$$M\,N = \sqrt{D\,N \times N\,B}$$

The Ellipse.



Circumference = mean of diameters × 3.1416 nearly or more accurately

$$\text{Cir.} = 1.5708\left(\sqrt{\frac{t^2+d^2}{2}} + \frac{t+d}{2}\right)$$

$$\text{Area} = .7854\ d\,t$$

$$y = \frac{c}{t}\sqrt{x\,(t-x)}$$

t being taken = A B; d = C D; x = A m; $t - x = m$ B; and y = any ordinate G m.

Area of an Elliptical Segment.—Find the segment area in table for circular segments by dividing the height of the elliptical segment by the diameter of which it is a part, and this tabular area multiplied by the product of the axes of the ellipse will be the area required.

To Find the Length of a Semi-Elliptical Arc.

Divide the height by the chord, and multiply the number opposite to the quotient in the following table by the same chord, and the product will be the length required:—

Table of the Length of Elliptical Arcs.

Chord = 1.

Height.	Length.	Height.	Length.	Height.	Length.
.100	1.04162	.125	1.06689	.150	1.09330
.101	1.04262	.126	1.06792	.151	1.09448
.102	1.04362	.127	1.06895	.152	1.09558
.103	1.04462	.128	1.06998	.153	1.09669
.104	1.04562	.129	1.07001	.154	1.09780
.105	1.04662	.130	1.07204	.155	1.09891
.106	1.04762	.131	1.07308	.156	1.10002
.107	1.04862	.132	1.07412	.157	1.10113
.108	1.04962	.133	1.07516	.158	1.10224
.109	1.05063	.134	1.07621	.159	1.10335
.110	1.05164	.135	1.07726	.160	1.10447
.111	1.05265	.136	1.07831	.161	1.10560
.112	1.05366	.137	1.07937	.162	1.10672
.113	1.05467	.138	1.08043	.163	1.10784
.114	1.05568	.139	1.08149	.164	1.10896
.115	1.05669	.140	1.08255	.165	1.11008
.116	1.05770	.141	1.08362	.166	1.11120
.117	1.05872	.142	1.08469	.167	1.11232
.118	1.05974	.143	1.08576	.168	1.11344
.119	1.06076	.144	1.08684	.169	1.11456
.120	1.06178	.145	1.08792	.170	1.11569
.121	1.06280	.146	1.08901	.171	1.11682
.122	1.06382	.147	1.09010	.172	1.11795
.123	1.06484	.148	1.09119	.173	1.11908
.124	1.06586	.149	1.09228	.174	1.12021

Height.	Length.	Height.	Length.	Height.	Length.
.175	1.12134	.206	1.15720	.237	1.19506
.176	1.12247	.207	1.15838	.238	1.19630
.177	1.12360	.208	1.15957	.239	1.19755
.178	1.12473	.209	1.16076	.240	1.19890
.179	1.12586	.210	1.16196	.241	1.20005
.180	1.12699	.211	1.16316	.242	1.20130
.181	1.12813	.212	1.16436	.243	1.20255
.182	1.12927	.213	1.16557	.244	1.20380
.183	1.13041	.214	1.16678	.245	1.20506
.184	1.13155	.215	1.16799	.246	1.20632
.185	1.13269	.216	1.16920	.247	1.20758
.186	1.13383	.217	1.17041	.248	1.20884
.187	1.13497	.218	1.17163	.249	1.21010
.188	1.13611	.219	1.17285	.250	1.21136
.189	1.13726	.220	1.17407	.251	1.21263
.190	1.13841	.221	1.17529	.252	1.21390
.191	1.13956	.222	1.17651	.253	1.21517
.192	1.14071	.223	1.17774	.254	1.21644
.193	1.14186	.224	1.17897	.255	1.21772
.194	1.14301	.225	1.18020	.256	1.21900
.195	1.14416	.226	1.18143	.257	1.22028
.196	1.14531	.227	1.18266	.258	1.22156
.197	1.14646	.228	1.18390	.259	1.22284
.198	1.14762	.229	1.18514	.260	1.22412
.199	1.14888	.230	1.18638	.261	1.22541
.200	1.15014	.231	1.18762	.262	1.22670
.201	1.15131	.232	1.18886	.263	1.22799
.202	1.15248	.233	1.19010	.264	1.22928
.203	1.15366	.234	1.19134	.265	1.23057
.204	1.15484	.235	1.19258	.266	1.23186
.205	1.15602	.236	1.19382	.267	1.23315

ELLIPTICAL ARCS—*continued.*

Height.	Length	Height.	Length.	Height.	Length.
.268	1.23445	.299	1.27535	.330	1.31748
.269	1.23575	.300	1.27669	.331	1.31886
.270	1.23705	.301	1.27803	.332	1.32024
.271	1.23835	.302	1.27937	.333	1.32162
.272	1.23966	.303	1.28071	.334	1.32300
.273	1.24097	.304	1.28205	.335	1.32438
.274	1.24228	.305	1.28339	.336	1.32576
.275	1.24359	.306	1.28474	.337	1.32715
.276	1.24480	.307	1.28609	.338	1.32854
.277	1.24612	.308	1.28744	.339	1.32993
.278	1.24744	.309	1.28879	.340	1.33132
.279	1.24876	.310	1.29014	.341	1.33272
.280	1.25010	.311	1.29149	.342	1.33412
.281	1.25142	.312	1.29285	.343	1.33552
.282	1.25274	.313	1.29421	.344	1.33692
.283	1.25406	.314	1.29557	.345	1.33833
.284	1.25538	.315	1.29603	.346	1.33974
.285	1.25670	.316	1.29829	.347	1.34115
.286	1.25803	.317	1.29965	.348	1.34256
.287	1.25936	.318	1.30102	.349	1.34397
.288	1.26069	.319	1.30239	.350	1.34539
.289	1.26202	.320	1.30376	.351	1.24681
.290	1.26335	.321	1.30513	.352	1.34823
.291	1.26468	.322	1.30650	.353	1.34965
.292	1.26601	.323	1.30787	.354	1.35108
.293	1.26734	.324	1.30924	.355	1.35251
.294	1.26867	.325	1.31061	.356	1.35394
.295	1.27000	.326	1.31198	.357	1.35537
.296	1.27133	.327	1.31335	.358	1.35680
.297	1.27267	.328	1.31472	.359	1.35823
.298	1.27401	.329	1.31610	.360	1.35967

ELLIPTICAL ARCS—*continued.*

Height.	Length.	Height.	Length.	Height.	Length.
.361	1.36111	.392	1.40627	.423	1.45214
.362	1.36255	.393	1.40773	.424	1.45364
.363	1.36399	.394	1.40919	.425	1.45515
.364	1.36543	.395	1.41065	.426	1.45665
.365	1.36688	.396	1.41211	.427	1.45815
.366	1.36833	.397	1.41357	.428	1.45966
.367	1.36978	.398	1.41504	.429	1.46167
.368	1.37123	.399	1.41651	.430	1.46268
.369	1.37268	.400	1.41798	.431	1.46419
.370	1.37414	.401	1.41945	.432	1.46570
.371	1.37662	.402	1.42092	.433	1.46721
.372	1.37708	.403	1.42239	.434	1.46872
.373	1.37854	.404	1.42386	.435	1.47023
.374	1.38000	.405	1.42533	.436	1.47174
.375	1.38146	.406	1.42681	.437	1.47326
.376	1.38292	.407	1.42829	.438	1.47478
.377	1.38439	.408	1.42977	.439	1.47630
.378	1.38585	.409	1.43125	.440	1.47782
.379	1.38732	.410	1.43273	.441	1.47934
.380	1.38879	.411	1.43421	.442	1.48086
.381	1.39024	.412	1.43569	.443	1.48238
.382	1.39169	.413	1.43718	.444	1.48391
.383	1.39314	.414	1.43867	.445	1.48554
.384	1.39459	.415	1.44016	.446	1.48697
.385	1.39605	.416	1.44165	.447	1.48850
.386	1.39751	.417	1.44314	.448	1.49003
.387	1.39897	.418	1.44463	.449	1.49157
.388	1.40043	.419	1.44613	.450	1.49311
.389	1.40189	.420	1.44763	.451	1.49465
.390	1.40335	.421	1.44913	.452	1.49618
.391	1.40481	.422	1.45064	.453	1.49771

Elliptical Arcs—*continued.*

Height.	Length.	Height.	Length.	Height.	Length.
.454	1.49924	.485	1.54718	.516	1.59568
.455	1.50077	.486	1.54875	.517	1.59720
.456	1.50230	.487	1.55032	.518	1.59876
.457	1.50383	.488	1.55189	.519	1.60032
.458	1.50536	.489	1.55346	.520	1.60188
.459	1.50689	.490	1.55503	.521	1.60344
.460	1.50842	.491	1.55660	.522	1.60500
.461	1.50996	.492	1.55817	.523	1.60656
.462	1.51150	.493	1.55974	.524	1.60812
.463	1.51304	.494	1.56131	.525	1.60968
.464	1.51458	.495	1.56280	.526	1.61124
.465	1.51612	.496	1.56447	.527	1.61280
.466	1.51766	.497	1.56605	.528	1.61436
.467	1.51920	.498	1.56763	.529	1.61592
.468	1.52074	.499	1.56921	.530	1.61748
.469	1.52229	.500	1.57089	.531	1.61904
.470	1.52384	.501	1.57234	.532	1.62060
.471	1.52539	.502	1.57389	.533	1.62216
.472	1.52691	.503	1.57544	.534	1.62372
.473	1.52840	.504	1.57699	.535	1.62528
.474	1.53004	.505	1.57854	.536	1.62684
.475	1.53159	.506	1.58009	.537	1.62840
.476	1.53314	.507	1.58164	.538	1.62996
.477	1.53460	.508	1.58319	.539	1.63152
.478	1.53625	.509	1.58474	.540	1.63309
.479	1.53781	.510	1.58629	.541	1.63465
.480	1.53937	.511	1.58784	.542	1.63623
.481	1.54093	.512	1.58940	.543	1.63780
.482	1.54249	.513	1.59096	.544	1.63937
.483	1.54405	.514	1.59252	.545	1.64094
.484	1.54561	.515	1.59408	.546	1.64251

Elliptical Arcs—*continued.*

Height.	Length.	Height.	Length.	Height.	Length.
.547	1.64408	.578	1.69308	.609	1.74283
.548	1.64565	.579	1.69467	.610	1.74444
.549	1.64722	.580	1.69626	.611	1.74605
.550	1.64879	.581	1.69785	.612	1.74767
.551	1.65036	.582	1.69945	.613	1.74929
.552	1.65193	.583	1.70105	.614	1.75091
.553	1.65350	.584	1.70264	.615	1.75252
.554	1.65507	.585	1.70424	.616	1.75414
.555	1.65665	.586	1.70584	.617	1.75576
.556	1.65823	.587	1.70745	.618	1.75738
.557	1.65981	.588	1.70905	.619	1.75900
.558	1.66139	.589	1.71065	.620	1.76062
.559	1.66297	.590	1.71225	.621	1.76224
.560	1.66455	.591	1.71286	.622	1.76386
.561	1.66613	.592	1.71546	.623	1.76548
.562	1.66771	.593	1.71707	.624	1.76710
.563	1.66929	.594	1.71868	.625	1.76872
.564	1.67087	.595	1.72029	.626	1.77034
.565	1.67245	.596	1.72190	.627	1.77197
.566	1.67403	.597	1.72350	.628	1.77359
.567	1.67561	.598	1.72511	.629	1.77521
.568	1.67719	.599	1.72672	.630	1.77684
.569	1.67877	.600	1.72833	.631	1.77847
.570	1.68036	.601	1.72994	.632	1.78009
.571	1.68195	.602	1.73155	.633	1.78172
.572	1.68354	.603	1.73316	.634	1.78335
.573	1.68513	.604	1.73477	.635	1.78498
.574	1.68672	.605	1.73638	.636	1.78660
.575	1.68831	.606	1.73799	.637	1.78823
.576	1.68990	.607	1.73960	.638	1.78986
.577	1.69149	.608	1.74121	.639	1.79149

ELLIPTICAL ARCS—*continued.*

Height.	Length.	Height.	Length.	Height.	Length.
.640	1.79312	.671	1.84391	.702	1.89519
.641	1.79475	.672	1.84556	.703	1.89685
.642	1.79638	.673	1.84720	.704	1.89851
.643	1.79801	.674	1.84885	.705	1.90017
.644	1.79964	.675	1.85050	.706	1.90184
.645	1.80127	.676	1.85215	.707	1.90350
.646	1.80290	.677	1.85379	.708	1.90517
.647	1.80454	.678	1.85544	.709	1.90684
.648	1.80617	.679	1.85709	.710	1.90852
.649	1.80780	.680	1.85874	.711	1.91019
.650	1.80943	.681	1.86039	.712	1.91187
.651	1.81107	.682	1.86205	.713	1.91355
.652	1.81271	.683	1.86370	.714	1.91523
.653	1.81435	.684	1.86535	.715	1.91691
.654	1.81599	.685	1.86700	.716	1.91859
.655	1.81763	.686	1.86866	.717	1.92028
.656	1.81928	.687	1.87031	.718	1.92195
.657	1.82091	.688	1.87196	.719	1.92363
.658	1.82255	.689	1.87362	.720	1.92531
.659	1.82419	.690	1.87527	.721	1.92706
.660	1.82583	.691	1.87693	.722	1.92868
.661	1.82747	.692	1.87859	.723	1.93036
.662	1.82911	.693	1.88024	.724	1.93204
.663	1.83075	.694	1.88190	.725	1.93373
.664	1.83240	.695	1.88356	.726	1.93541
.665	1.83404	.696	1.88522	.727	1.93710
.666	1.83568	.697	1.88688	.728	1.93378
.667	1.83733	.698	1.88854	.729	1.94046
.668	1.83897	.699	1.89020	.730	1.94215
.669	1.84061	.700	1.89186	.731	1.94383
.670	1.84226	.701	1.89352	.732	1.94552

Height.	Length.	Height.	Length.	Height.	Length.
.733	1.94721	.764	1.99989	.795	2.05331
.734	1.94890	.765	2.00160	.796	2.05505
.735	1.95059	.766	2.00331	.797	2.05679
.736	1.95228	.767	2.00502	.798	2.05853
.737	1.95397	.768	2.00673	.799	2.06027
.738	1.95566	.769	2.00844	.800	2.06202
.739	1.95735	.770	2.01016	.801	2.06377
.740	1.95994	.771	2.01187	.802	2.06552
.741	1.96074	.772	2.01359	.803	2.06727
.742	1.96244	.773	2.01531	.804	2.06901
.743	1.96414	.774	2.01702	.805	2.07076
.744	1.96583	.775	20.1874	.806	2.07251
.745	1.96753	.776	2.02045	.807	2.07427
.746	1.96923	.777	2.02217	.808	2.07602
.747	1.97093	.778	2.02389	.809	2.07777
.748	1.97262	.779	2.02561	.810	2.07953
.749	1.97432	.780	2.02733	.811	2.08128
.750	1.97602	.781	2.02907	.812	2.08304
.751	1.97772	.782	2.03080	.813	2.08480
.752	1.97943	.783	2.03252	.814	2.08656
.753	1.98113	.784	2.03425	.815	2.08832
.754	1.98283	.785	2.03598	.816	2.09008
.755	1.98453	.786	2.03771	.817	2.09198
.756	1.98623	.787	2.03944	.818	2.09360
.757	1.98794	.788	2.04117	.819	2.09536
.758	1.98964	.789	2.04290	.820	2.09712
.759	1.99134	.790	2.04462	.821	2.09888
.760	1.99305	.791	2.04635	.822	2.10065
.761	1.99476	.792	2.04809	.823	2.10242
.762	1.99647	.793	2.04983	.824	2.10419
.763	1.99818	.794	2.05157	.825	2.10596

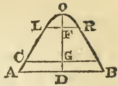
Elliptical Arcs—*continued.*

Height.	Length.	Height.	Length.	Height.	Length.
.826	2.10773	.857	2.16309	.888	2.21937
.827	2.10950	.858	2.16489	.889	2.22120
.828	2.11127	.859	2.16668	.890	2.22303
.829	2.11304	.860	2.16848	.891	2.22486
.830	2.11481	.861	2.17028	.892	2.22670
.831	2.11659	.862	2.17209	.893	2.22854
.832	2.11837	.863	2.17389	.894	2.23038
.833	2.12015	.864	2.17570	.895	2.23222
.834	2.12193	.865	2.17751	.896	2.23406
.835	2.12371	.866	2.17932	.897	2.23590
.836	2.12549	.867	2.18113	.898	2.23774
.837	2.12727	.868	2.18294	.899	2.23958
.838	2.12905	.869	2.18475	.900	2.24142
.839	2.13083	.870	2.18656	.901	2.24325
.840	2.13261	.871	2.18837	.902	2.24508
.841	2.13439	.872	2.19018	.903	2.24691
.842	2.13618	.873	2.19200	.904	2.24874
.843	2.13797	.874	2.19382	.905	2.25057
.844	2.13976	.875	2.19564	.906	2.25240
.845	2.14155	.876	2.19746	.907	2.25423
.846	2.14334	.877	2.19928	.908	2.25606
.847	2.14513	.878	2.20110	.909	2.25789
.848	2.14692	.879	2.20292	.910	2.25972
.849	2.14871	.880	2.20474	.911	2.26155
.850	2.15050	.881	2.20657	.912	2.26338
.851	2.15229	.882	2.20839	.913	2.26521
.852	2.15409	.883	2.21022	.914	2.26704
.853	2.15589	.884	2.21205	.915	2.26888
.854	2.15770	.885	2.21388	.916	2.27071
.855	2.15950	.886	2.21571	.917	2.27254
.856	2.16130	.887	2.21754	.918	2.27437

Elliptical Arcs—*continued.*

Height.	Length.	Height.	Length.	Height.	Length.
.919	2.27620	.946	2.32598	.973	2.37716
.920	2.27803	.947	2.32785	.974	2.37908
.921	2.27987	.948	2.32972	.975	2.38100
.922	2.28170	.949	2.33160	.976	2.38291
.923	2.28354	.950	2.33348	.977	2.38482
.924	2.28537	.951	2.33537	.978	2.38673
.925	2.28720	.952	2.33726	.979	2.38864
.926	2.28903	.953	2.33915	.980	2.39055
.927	2.29086	.954	2.34104	.981	2.39247
.928	2.29270	.955	2.34293	.982	2.39439
.929	2.29453	.956	2.34483	.983	2.39631
.930	2.29636	.957	2.34673	.984	2.39823
.931	2.29820	.958	2.34862	.985	2.40016
.932	2.30004	.959	2.35051	.986	2.40208
.933	2.30188	.960	2.35241	.987	2.40400
.934	2.30373	.961	2.35431	.988	2.40592
.935	2.30557	.962	2.35621	.989	2.40784
.936	2.30741	.963	2.35810	.990	2.40976
.937	2.30926	.964	2.36000	.991	2.41160
.938	2.31111	.965	2.36191	.992	2.41362
.939	2.31295	.966	2.36381	.993	2.41556
.940	2.31479	.967	2.36571	.994	2.41749
.941	2.31666	.968	2.36762	.995	2.41943
.942	2.31852	.969	2.36952	.996	2.42136
.943	2.32038	.970	2.37143	.997	2.42329
.944	2.32224	.971	2.37334	.998	2.42522
.945	2.32411	.972	2.37525	.999	2.42715

Parabola.



$$\text{Area} = \tfrac{2}{3}\,\text{O D} \times \text{A B}$$

$$\text{F O} = \tfrac{1}{4}\,\text{L R} = \frac{\text{C G}^2}{4\,\text{O G}}$$

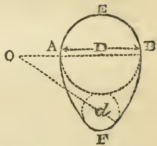
If m = the focal distance O F; y = ordinate C G and x = the abscissa O G, then

$$y = \sqrt{4\,m\,x}$$

from which the curve may be constructed.

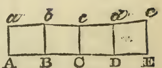
Length of arc $= 2\sqrt{y^2 + \tfrac{4}{3}x^2}$ nearly.

Egg-Shaped Sewers.



Diameter A B = D
E F = D + d
O B = E F
Area = 1.1597 D².
Area of part below A B = .767 D².
Area of part above A B = .3927 D².
The perimeter or length A E B F = 3.9649 D.
The perimeter of part A F B = 2.39415 D.

The Area of Irregular Figures.



Measure the heights or ordinates Aa, Bb, Cc, &c., at equal distances apart, then

The area will equal the mean of the extreme ordinates (as Aa and Ee) added to the sum of the intermediate ones, and multiplied by the whole length of the figure divided by the number of ordinates.

Cubes, &c.

The solidity of cubes, parallelopipedons and prisms, is found by multiplying the area of the base by the perpendicular height.

Cylinders.

Solidity = area of base × perpendicular height.

Surface = circumference × length + twice the area of the base.

Capacity of a cylinder 1 foot diameter and 1 foot long = 4.8947 imperial gallons.

Cylindrical Ring.

t = thickness of ring ; d = inner diameter.

Solidity = 2.4674 $t^2 (d + t)$.

Surface = 9.8696 $t (d + t)$.

Pyramids and Cones.

Solidity = area of base multiplied by $\frac{1}{3}$rd of the perpendicular height.

Surface = slant height multiplied by half the girth at base, to which add the area of base.

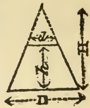
Frustums of Pyramids and Cones.

A a = areas of the ends,
h = the perpendicular height.

$$\text{Solidity} = \frac{h}{3}(\sqrt{A\,a} + A + a).$$

Surface = mean circumference or girth multiplied by the slant height, to which add the areas of the ends.

To find the height, H, of a cone from which a given frustum has been cut: let h = height of frustum; D=diameter at base; d=diameter at top, then



$$H=\frac{D\,h}{D-d}$$

Wedges.

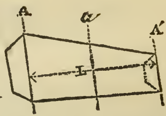
If b and L=breadth and length of back; E=length of edge; and h=perpendicular distance between the back and edge, we have

$$\text{Solidity}=\frac{b\,h\,(2\,L+E)}{6}$$

If the edges are parallel but of different lengths, the solidity=$\frac{1}{3}$rd of the sum of the edges multiplied by the area of a section taken at right angles to them.

Prismoid.

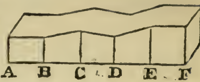
If A and A′=areas of end sections, a=area of middle section, and L=the length.



$$\text{Solidity}=\frac{L\,(A+4\,a+A')}{6}$$

Note.—The sections are to be taken parallel to each other, and the area of the middle section to be calculated from the mean dimensions, and not by averaging the areas of the ends.

The Content of Cuttings and Embankments.



Divide the figure into any number of parallel and equidistant sections, as at A, B, C, D, E, and F, find the area of each, and also of a section midway between them, as explained in the previous note; then

To the end sections, as at A and F, add twice the sum of the sections taken at the equidistant parts, B, C, D, and E, and four times the sum of the intermediate sections, this sum multiplied by one-sixth of the length of one of the parts, as A, B, will give the solid content.

When the surface is of great extent it is best to divide it into triangles, find the horizontal area of each, and multiply by one-third of the sum of the vertical depths taken at the angles, and the result will be the solidity.

Globes or Spheres.

A globe is equal to a pyramid or cone whose base and altitude are equal to the surface and radius.

If d=diameter

Surface$=3.1416\ d^2$.

Solidity$=.5236\ d^3$.

Note.—The solidity of a sphere equals $\frac{2}{3}$rds of the solidity of its circumscribing cylinder, and the curved surface equals the circumference of the same cylinder multiplied by its height.

The surface of a sphere multiplied by *one-sixth* of its diameter will equal the solidity.

Segment of a Sphere.

Let d=diameter of base, and h=height of segment.

Solidity=$.5236\ h^2\ (3\ d-2\ h)$, or

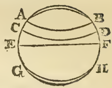
if r=radius of base of segment,

Solidity=$.5236\ h\ (3\ r^2+h^2)$.

Convex surface=C h.

C being the circumference of the whole sphere from which the segment was taken.

The Frustum or Zone of a Sphere.



R=Radius of greater end, C D.
r=Radius of lesser end, A B.
h=Height of frustum.

Solidity=$1.5708\ h\left(R^2+r^2+\frac{h}{3}\right)$

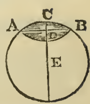
The Middle Zone of a Sphere.

D=Diameter, E F, of whole sphere, and h=height or thickness of zone,

Solidity=$.7854\ h\ (D^2-\frac{1}{3}\ h^2)$.

The surface is found in the same manner as for the segment of a sphere.

Circular Spindles.



Let a=area of the generating circular segment A, C, B; l=length A B; and s=D E, or the radius minus the versed sine D C,

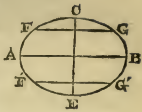
Solidity=$.5236\ (l^3-12\ a\ s)$

Surface=$6.2832\ (l\,r-s\ e)$.

r being the radius of the generating circle, and e the length of the arc, A, C, B.

Spheroid.

If D = the fixed axis d = the revolving axis.



$$\text{Solidity} = .5236 \text{ D } d^2$$

Note.—A problate spheroid revolves on its longer axis; an oblate spheroid on its shorter axis.

Segment of a Spheroid.

h = height of segment and D d, as before.

$$\text{Solidity} = \frac{.5236\, d^2\, h\, (3\text{ D} - 2\, h)}{\text{D}^2}$$

The Middle Zone of a Spheroid.

D = Middle diameter A B; d = that of the ends F G.

h = height or distance between the ends.

$$\text{Solidity} = .2618\, h\, (2\text{ D}^2 + d^2)$$

Note.—This is similar in shape to a cask of the *first* variety.

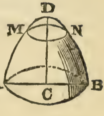
Parabolic Conoid.

If D = diameter at base, and h = height.

$$\text{Solidity} = .3927\, h\text{ D}^2$$

Frustum of a Parabolic Conoid.

d = diameter at upper end M N.



$$\text{Solidity} = .3927\, h\, (\text{D}^2 + d^2).$$

Note.—The double frustum of a parabolic conoid is similar to a cask of the *third* variety, in which D would represent the bung diameter, and d that of the head.

Parabolic Spindle.

D = diameter at the middle, and l = the length.

Solidity = 41888 $D^2 l$.

The Middle Frustum of a Parabolic Spindle.

Solidity = $.2618\, l\, (2\, D^2 + d^2 - .4\, (D - d)^2)$.
d being taken equal to the diameter at the end.

Note.—This is similar to a cask of the *second* variety.

Regular Solids.

To find the surface and solid contents of any of the regular bodies :—

Multiply the tabular *area* by the *square* of the linear edge of the solid, and the product will equal the surface, and

Multiply the tabular *solidity* by the *cube* of the linear edge for the solidity.

No. of Sides.	Name.	Area.	Solidity.
4	Tetraedon......	1.7320508	0.1178513
6	Hexaedron ...	6.0000000	1.0000000
8	Octaedron......	3.4641016	0.4714045
12	Dodecaedron .	20.6457288	7.6631189
20	Icosaedron ...	8.6602540	2.1816950

Gauging of Casks.

Let M = the middle or bung diameter.

D = diameter at end.

Casks of the First Variety,
Considerably curved.

Capacity in Imp. galls. $= .0009442\, l\, (2\, M^2 + D^2)$.

Casks of the Second Variety,
Moderately curved.

Capacity in Imp. galls. $= .0009442\, l$
$$\left((2\, M^2 + D^2) - \tfrac{2}{5}\, (M - D)^2 \right)$$

Casks of the Third Variety,
With very little curve.

Capacity in Imp. galls. $= .0014162\, l\, (M^2 + D^2)$.

Hutton's Rule for Casks of any form.

Capacity in Imp. galls. $= .00003147\, l$
$(39\, M^2 + 25\, D^2 + 26\, M\, D)$.

Ullage of Casks.

To find the content of a lying cask when partly full:—

Divide the depth of the liquid in inches by the bung diameter in inches; and if the quotient is less than .5, deduct from it one-fourth of the difference; but if the quotient exceeds .5, add one-fourth of that excess to it, and multiply either the remainder in the former case, or the sum in the latter, by the whole capacity of the cask, and the product is the content in Imperial gallons.

To find the content of a standing cask when partly full:—

Divide the depth of the liquid by the length of the cask, both in inches; then if the quotient is less than .5, subtract from it one-tenth part of

the difference, but if greater than .5, add one-tenth of its excess, and multiply the remainder in the former case, or the sum in the latter, by the whole capacity of the cask, and the product is the content in Imperial gallons.

Timber Measure.

Table for Measuring Timber.

Quarter Girth.	Area.	Quarter Girth.	Area.	Quarter Girth.	Area.	Quarter Girth.	Area.
inches.	feet.	inches.	feet.	inches.	feet.	inches.	feet.
3	.063	7½	.390	12	1.000	16½	1.890
3¼	.073	7¾	.417	12¼	1.042	16¾	1.948
3½	.085	8	.444	12½	1.085	17	2.006
3¾	.093	8¼	.472	12¾	1.129	17¼	2.066
4	.111	8½	.501	13	1.174	17½	2.126
4¼	.125	8¾	.531	13¼	1.219	17¾	2.187
4½	.140	9	.562	13½	1.265	18	2.250
4¾	.157	9¼	.594	13¾	1.313	18½	2.376
5	.174	9½	.626	14	1.361	19	2.506
5¼	.192	9¾	.659	14¼	1.410	19½	2.640
5½	.210	10	.694	14½	1.460	20	2.777
5¾	.230	10¼	.730	14¾	1.511	20½	2.917
6	.250	10½	.766	15	1.562	21	3.062
6¼	.272	10¾	.803	15¼	1.615	21½	3.209
6½	.294	11	.840	15½	1.668	22	3.362
6¾	.317	11¼	.878	15¾	1.722	22½	3.516
7	.340	11½	.918	16	1.777	23	3.673
7¼	.364	11¾	.959	16¼	1.833	24	4.000

The Solidity of Round or Unsquared Timber.

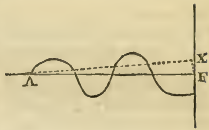
Gird the timber round the middle with a string, and one fourth of this girth squared and multiplied by the length will equal the solidity. If the circumference is taken in inches and the length in feet, divide by 144 to obtain the result in cubic feet.

If the bark is on the tree a deduction is to be made from the quarter girth of about $\frac{1}{2}$ inch for ash and beech, and from 1 to 2 inches for oak, elm, and fir, according to the thickness of the bark.

If the tree is very irregular or tapers much, divide it into several lengths, and measure each separately.

The Partition of Land, &c.

To substitute a straight line for an irregular one, so that the areas on each side shall remain the same.



From the proposed origin A, of the straight line required, measure an assumed or trial line as A X, approximating to the true one as near as possible.

Then take the sum of the areas on the right and also on the left of this line and divide twice the difference by the length of the trial line, and the quotient will be the perpendicular distance from the end X, to which the required line A F must be drawn, in order that the areas on both sides, bounded by the irregular one, may be equal.

The perpendicular to be drawn on that side of the line A X, where the areas are greatest.

THE MEASUREMENT OF BUILDERS' WORK.

The operations comprised in Builders' Measurements are:—

1. Taking the dimensions.
2. Squaring, abstracting, and bringing the quantities into bili.
3. The preparation of the Estimate—which consists in attaching prices to the items of the bill, moneying them out and casting up the result.

The dimensions are taken in feet and inches, either from the actual work itself, termed "Measuring up," or they are taken from the drawings before the work has been executed, which is termed "Taking out the Quantities." The mode of proceeding in both cases is nearly the same.

Commence by writing in the dimension book, or on paper ruled for the purpose, the name of the work and that of the Surveyor who attends on the opposite side, and the date.

Take the several parts of the work in the order most convenient, observing always to enter the length first, next the width, and, lastly, the depth or thickness.

When several lengths have to be added together note the process in the margin of the dimension book, technically termed "on waste." Also describe the nature of the material and workmanship, and the exact situation of the work. A strict observance of these rules will greatly facilitate the future identification of the dimensions with the work from which they have been taken, should a reference to them be required in case of dispute.

EXCAVATORS' WORK.

General Excavators' Work.

At per cubic yard.

Take the excavation as digging and throwing out, under 6 feet in depth, and wheeling under 20 yards, or basketing where wheeling is impracticable.

When the depth exceeds 6 feet, or the distance to be removed is more than 20 yards, or if the road or run is inclined state the particulars, also describe the nature of the soil.

Trenches for Foundations.

At per cubic yard.

Trenches for foundations are usually kept separate from the general excavation, and described as digging trenches for foundations, including part filled in and rammed after the walls are built and the remainder removed, or the digging and removing is taken by itself, and the filling and ramming made a distinct item. A deduction being made from the former equal to the latter.

Allow a width of 6 inches on each side of the footings to give the bricklayer room to work. Where there are concrete foundations allow only the net width of the concrete.

Trenches for Drains, Pipes, &c.

At per yard run.

State the depth and size of pipe or drain.

Allowance for Slopes.

No excavation except in rock or chalk is supposed to stand vertically, therefore, an addition for sloping sides should be taken to the digging. It will generally be sufficient to allow 3 inches on each side for every foot in depth.

For pipes it is usual to take the bottom of the trench about 9 inches wider than the diameter of the pipe.

Shoring and Strutting, &c.

At per yard run.

When the excavation is deep and the soil loose, instead of allowing for slopes, the length should be measured for shoring and planking to sides of excavation, describing the depth and width. Narrow trenches, under 6 feet wide, should be described as Strutting and Planking to sides of narrow excavations, according to the depth and width.

Wells and Circular Cesspools.

At per yard cube.

Measure as before, and state the depth, nature of soil, and distance to be removed.

Wells when Steined.

Wells that are to be steined are usually numbered and described as "Digging and Steining;" gear, tackle, buckets, and stages included. State the depth and diameter in clear of the steining, the nature of the Steining, whether laid in mortar, cement or left dry, and state if Puddle is required. Take curbs and the permanent pumps extra.

Pumping.

State in any of the foregoing items if pumping is likely to be required.

Clay Puddle over Vaults and Arches.

At per yard superficial.

State the height of the arches above the ground and the thickness of the puddle required.

Pile Driving.

Number the piles, state the kind of timber, the scantling and the length in feet to be driven.

Number the ringing, pointing, and shoeing, and state the weight of the rings and shoes.

Concrete.

Concrete in foundations, or otherwise, in thicknesses of 12 inches or over, is charged at per cubic yard.

Concrete under pavings or hearths, or where the thickness is less than 12 inches, is taken at per yard superficial.

When concrete is filled in over arches or lifted to a height above the ground it is described as such and the height stated.

BRICKLAYERS' WORK.

Brickwork in General.

At per rod reduced.

Measure brickwork superficially in feet and inches, and state the number of bricks in thickness.

In very thick walls or where the thickness is irregular, it is sometimes more convenient to take all the dimensions in feet and inches and afterwards to reduce them to the standard thickness of 1½ bricks. Walls under 1½ bricks thick, or where the joints are struck on both sides, should be kept separate.

Circular brickwork is classified according to curvature into "Flat Sweep" when above, and "Quick Sweep" when below 25 feet radius, and the face only to be taken as extra; in "Very Quick Sweep" describe the brickwork as being circular in addition to the face, more labour being entailed in the body of the wall.

Take all deductions as they appear.

Window Sills, stone, or woodwork under 6 inches in height are not to be deducted.

Wall plates when no brickwork is over them are to be measured in if they do not exceed 3 inches in height, if more include only 3 inches to pay for bedding and the trouble of fixing.

No allowance in quantity is to be made for small or difficult works. The labour on them should be charged separately.

Measure all cuttings over 6 inches wide, by the foot superficial, state if fair cut and rubbed, and whether to splays, rakes, or otherwise.

Facings, when ordered, to be taken in addition to the brickwork at per foot superficial. They are usually described as "Extra to face of selected bricks including pointing," or as the case may be.

Reveals to doors and window openings are kept separate when plastered or different from the front.

Internal angles or "birdsmouth," and external angles or squint quoins are measured at per foot run, and described as fair or rough, as the case may be.

Chimney Shafts and Flues.

Chimneys and Flues are measured as solid.

The opening for the fire-places only being deducted.

Take fire-bricks and fire-lumps extra.

Number the coring of the flues.

Take chimney bars according to size, and 18 inches longer than the clear opening; unless otherwise specified They are afterwards inserted in the Smith's bill by weight.

Ovens and Coppers.

At per foot cube.

Brickwork in Ovens and Coppers is measured solid, deducting the ash holes only.

Fire-bricks and fire-lumps are taken extra.

Arches and Vaults.

At per rod reduced.

Take the mean girth by the length and thickness; describe how they are to be executed, whether straight, askew, spandril on plan, flueing, or otherwise.

In Groined Arches, when the groins spring from four piers or angles, the parts groined are kept separate and the run of cut and rubbed groin point taken in addition; in other cases take the cut and rubbed groin point only. In all cases the thickness of groined arches should be stated, in order that the amount of rough cutting at the intersection of the arches may be known.

Some Surveyors, however, make no distinction for groined arches, beyond taking the run of groin point.

Measure the soffits of all arches and vaults for centering; that for groined, flueing, and similar arches is to be kept separate. Take groin points, cuttings, and extra ribs where required.

Take raking out and pointing to soffits; an operation which cannot be performed until after the centres have been removed.

Take the rough cuttings for skewbacks and the other cuttings when the arches are not straight.

The faces of skew arches require to be fair cut.

Walls built over and under the arches require to be rough cut to fit the curvature.

Trimmer arches are to be taken at per foot superficial, stating the thickness.

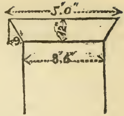
Arches Gauged or Fair Axed.

At per foot superficial.

Gauged arches over door or window heads are to be taken as extra to the ordinary brickwork, deducting for the facing only.

Measure the width of the opening between the reveals, and add the projection of one skewback; this length by the height will give the face, to which add the soffit, for example:—

4	3	Extra to gauged arches
1	0	and Ddt. external facing.
3	6	
0	$4\frac{1}{2}$	add gauged soffit.



3	6	opening
0	9	skewback
4	3	

When the arches are cambered or curved they are measured in the same manner, the net face and soffit being taken.

Take turning pieces for the straight or cambered arches at per foot run, stating the width of soffit, whether $4\frac{1}{2}$ inches or 9 inches.

Take centres for the other arches at per foot superficial.

Rendering.

At per yard superficial.

Rendering in cement by the bricklayer is charged as rendering from the trowel.

Pointing.

At per yard superficial.

Describe as "raking out joints and pointing with coal ash mortar or cement," as the case may be, or if Tuck pointed.

Bricknogging.

At per yard superficial.

Take the length by the height, and deduct all the openings, but not the timbers.

Brick or Tile Paving.

At per yard superficial.

Describe the bricks or tiles used, and state the thickness of the tiles, if the bricks are laid flat or on edge, in mortar or in sand.

Brick on Edge Coping.

At per foot superficial.

State if in cement or in mortar. Sometimes it is taken by the foot run, and when so, state if on 1 or 1½ brick wall, &c., as the case may be.

Tiling.

At per square of 100 *superficial feet.*

In Plain Tiling—
  Allow for the Eaves 4 inches extra.
  " dripping ditto 6 inches extra.
  " all cuttings, hips, &c., 3 inches extra.
  " Valleys 12 inches extra.

In Pantiling—
  Take the length of the hip rafter by 12 inches for cutting and waste.
  Take the run of "Hips and Ridges."
  Take the run of mortar or cement filleting, also the plain tile heading.

In both cases number the hip hooks and T nails, and the painting in oil.

State the gauge of the tiles, the quantity and description of the laths and nails used, also if laid dry or pointed, outside or inside with mortar.

Drains.

At per foot run.

Describe and state if in mortar or cement. If barrel drains state the number of half bricks in the thickness.

State if digging is included.

Moulds, templates, and centres for drains are charged extra.

In pipe drains, all bends and junctions are taken extra.

Cesspools.

It is customary to number Cesspools. State if square or circular, also the depth, width, or diameter, description of lining, and if rendered on the inside with cement.

Making good pipes or other drains to Cesspools is charged extra.

Miscellaneous.

Take Fascias, Beads and Quirks, Rounded Angles, Dentil or Plain Cornices, at per foot run.

Number the Mitres and Stopped ends to all Splays, rounded Angles, &c. Also number the bedding and pointing to Door and Window Frames; ends of Timbers cut and pinned. Ventilators and Air-bricks built into walls, forming and rendering the appertures for same. Chimney-pots and fixing. Ranges and Stoves fixed. Chimney Pieces fixed. Chimney openings rendered and blackened.

The term "Labour only" is exclusive of Scaffolding, but includes its erection.

"Labour and Mortar" includes Scaffolding and other materials except bricks.

MASONS' WORK.

In districts where stone abounds and forms the principal material for building, ordinary walls are commonly built of rubble stone, and paid for by the cubic yard, or some other local standard, according to the quality of the work—as "coursed" or "uncoursed" "in foundations," "walling," &c. A considerable quantity of work-

manship is frequently applied to this kind of Masonry, so that sometimes it becomes little inferior, on the face, to dressed block stone.

The face work is measured separately, and paid for by the foot superficial, as "scabbled," "hammered," "axed," &c., including any squaring to the beds and joints of the facing Stone.

Quoins of selected stones are described and charged at per foot in height, but superior quoins are taken as block stone, and other dressings are taken in a similar manner.

Block stone is charged in the quarries at per cubic foot, or per ton, and the price varies as follows: viz.—

1. When one dimension is fixed, as the height of a course of ashlar; and the other two dimensions are left, more or less, to the option of the quarryman.
2. When two dimensions are fixed, as the height and width of a coping, and the third dimension is left optional.
3. When all the dimensions of a stone are fixed.

The value of a block of stone will be reduced if the back be not scabbled square, but left rough to tail in with a rubble wall or otherwise; and it will be still more reduced in value, if, in addition to the back, some portion of the sides or joints also be left rough.

Walling of block stone is charged at per cubic foot according to description, as ashlar prepared and set, including all beds and joints, but the face is charged extra at per foot superficial, as "drafted and picked," "tooled," "rubbed," &c.

Copings, Arch Stones, &c., are charged at per cubic foot for the rough stone and setting, the dimensions of each stone being taken as that of the smallest rectangular block from which it could be prepared; and the dressing is measured on the surfaces of the prepared block (measured net on the finished surface), and charged as "beds and joints," "sunk joints," "plain face," "sunk face," &c.; or, more commonly, an addi-

tion is made to the cubic price of the stone for plain beds and joints, and only the face work and sunk joints charged as superficial work.

In London, in consequence of the difficulty and expense of carriage, very little stone, comparatively, is used, and that little is chiefly in small quantities, and in small scantlings.

The building stone used in London is chiefly obtained from the island of Portland, or from the neighbourhood of Bath. Both of these descriptions of stone are quarried from the same geological formation, and they are very easily wrought. Portland stone is brought to the London market in roughly hewn rectangular blocks, which are sold by the ton of 16 cubic feet, one inch in each dimension of the block being allowed for irregularities and waste.

The London Mason cuts the block into scantlings by means of the saw, and his work is measured as follows:—

Material.

Per foot cube.

Take the size of the stone as it comes from the banker, and describe as "Cube stone, including hoisting and setting."

All stones above 6 feet long to be described as scantling lengths, and each size kept separate.

The height to be stated when the work is more than 40 feet from the ground.

All stones under 3 inches in thickness are to be measured by the foot superficial.

Labour in General.

Per foot superficial.

It is the practice with most Surveyors to take only one bed and one joint to each stone; it is best, however, to measure all, and to state that such has been done.

One joint only to be allowed to every 3 feet in length when the work is continuous, as in strings, copings, &c.

Take half sawing to all sawn faces, on which no other labour has been taken, including the original surfaces lost in sunk work.

Take plain work rubbed (which includes sawing) to all faces and returned ends unless otherwise worked.

Girth the sunk work, moulded work, circular plain, and circular moulded work as it appears, and take half sawing on the original surfaces extra.

Take splayed and fair edges under 6 inches wide, back joint, throating, grooving, sunk rebates, mitres to sinkings, chamfers, reeds, flutings, haunches, joggle and iron or copper tongued joints, cutting and pinning to landings, &c., by the foot run.

Number fair ends to steps, pipe holes, cramps, plugs, dowels, mortice holes for doorposts, rounded corners, notchings, letting in coal plates, air traps, sink stones, cutting and pinning ends of steps, stopped and bevel ends to sinkings, mitres to mouldings, external and internal (according to girth), returned and mitred ends to copings, neckings to chimney pieces, &c.

DEFINITIONS OF TERMS FOR THE LABOUR ON STONE.

Plain Work—is the even surface produced without sinking more than necessary to remove the mere irregularities of the stone.

Sunk Work—is the cutting or chiselling below the plain surface, as in rebating, or the weatherings of String courses, copings, and cornices.

Circular Work—is the labour required to form convex or concave surfaces, as to the shafts of columns, arch stones, or circular curbs.

Circular Circular Work—is that required to form a sphere or a niche head.

Moulded Work, Straight—is that to cornices, &c.

Moulded Work, Circular—is that to the necking or capitals of columns.

EXAMPLES OF THE MODE OF MEASURING PORTLAND STONEWORK, &c., FOR MATERIALS AND LABOUR.

Plain Solid Steps.

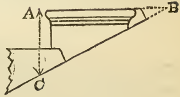
Per foot run.

Measure the length, and describe the width and depth. State if tooled on tread and riser and back-jointed, or tooled all round, as the case may be.

Take fair or rounded ends, or cutting and pinning to walls, &c., extra.

When steps are bedded on brickwork or stonework it should be stated.

Spandril Steps.



For the Cubic Quantity of the stone. Take the length by the width, measured from the nose of the tread at A to the end of the acute angle at B, and by half the height of the riser, measured from the top of the tread at A to C where the vertical line intersects the soffit.

Take Plain Work (rubbed) to tread and soffit as seen when worked.

Take the girth of the rebate by the length, as Sunk Work.

Take the length of the nosing, including the returned end, by the girth as Moulded Work, and the face of the riser from the nosing to the rebate as Sunk Work.

Take sawing to the original surfaces of the Sunk and Moulded Work.

Number the Mitres to Moulding (state the girth)

" 1. Returned end to moulding.
" 1. Step cut and pinned in wall.
" 2. Holes sunk for balusters.

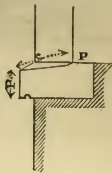
WINDOW SILLS.

Take the extreme dimensions for the CUBIC QUANTITY of stone.

PLAIN WORK, P to the top, front and underside of projection.

The girth of the top S, as SUNK WORK, and the original surface as PLAIN BED.

Sawn sides and ends as HALF SAWING, when no other labour is taken.



Run of THROAT and describe as stopped.

Number of returned FAIR ENDS.

Number of STOPPINGS, describing their length.

"Making good to window sills" should be taken if the stone is deducted from the brickwork.

CORNICES, &c.

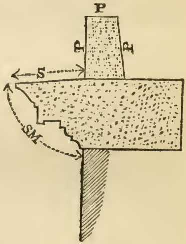
Take for the Cornice—

The extreme dimensions for the CUBIC QUANTITY of stone.

BEDS and JOINTS for the top, bottom, and ends.

SUNK WORK to the top measured from the blocking course to the outer edge.

MOULDED WORK from the edge of the Sunk work over the face and soffit to the wall.



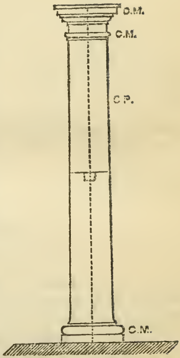
HALF SAWING to the face and back (if sawn).

Take for the Blocking—

The length and height by the mean thickness, *plus* $\frac{1}{2}$ inch for waste in sawing, as the dimension for the quantity of stone.

Beds and Joints.
Plain Work to front, top, and back.
Run of Groove for plug.
Number of plugs and running with lead.

Columns.



Shaft exclusive of Base or Capital.

Take for the cube of material the extreme dimensions of each stone as if square.

Half Sawing on two sides (if sawn)

Plain Joints where jointed.

Half Plain Work on two sides.

Circular Plain Work to girth of Shaft.

Circular Moulded Work to Necking.

Number of Mortice holes and dowels.

Capital and Base—

Take extreme dimensions as before for the material.

Half Plain top, bottom, and sides.

Plain Work rubbed to fillet on top of capital and to plinth.

Circular Moulded Work. Average horizontal girth by vertical girth of moulding.

Mortices and Dowels as last.

Bath and Yorkshire Stone are measured in the same way as Portland Stone; but for ordinary work Yorkshire steps, curbs, &c., may be obtained in the London market ready dressed from the quarry, and they are usually

... charged at lower rates than if they were prepared from the block stone in London.

Yorkshire Landings and Pavings are measured by the foot superficial, stating the thickness, and if tooled on one or both faces, or otherwise.

Take the tooled edges to the landings, when over 6 inches wide, by the foot superficial; and when under 6 inches, by the foot run according to width. Take cuttings and pinning, joggle joints, &c., to landings, the same as for Portland Stone. Take coped edge to paving when a close fitting joint is required.

To Granite and other stones not usually sawn, two beds and two joints are taken where only one is frequently taken to Portland or other sawn stones.

In Granite all beds and joints are described as "plain picked," or "plain axed beds and joints," and the stones are measured at their largest dimensions for the cubic contents, as they cannot be sawn one out of another.

Regulations for the Measurement of Masonry, prescribed in the Contract for the Erection of the Houses of Parliament.

Cube Stone—If square to be measured the net size when worked, but when the stones are not of a square form to be measured to the size of a square stone of the least extent required. Where the stones are of scantling lengths of 6 feet or upwards they are to be measured separately from the ordinary cube stone.

Drafted Backs—The backs of the stones where drafted to be measured according to the surface actually shown.

Plain and Sunk Beds—One plain bed only to be taken for each stone, except to mullions of windows, for which two beds are to be taken to each stone. Ordinary arch stones to be considered as having one plain bed and one sunk bed.

Plain and Sunk Joints—Not more than one plain joint to be taken for each stone, having one or more plain joints. All sunk joints to be taken as they occur

Chiselled or Rubbed Faces—To be measured to the size actually shown on the external surface.

Rough Sunk—To be taken when a large quantity of stone has to be removed, as in stop mouldings to sills, window heads, and other similar work.

Sunk, Chiselled, or Rubbed Faces—To be measured on the surface actually worked, adding the depth of the sinking.

Stopped Sinking—To be measured in such situations as do not permit the work to be carried straight through the stone, as in sills of windows and other similar work.

Preparatory Labour or Plain Face as Bed—To be taken wherever it is necessary to produce a face for the purpose of setting out under work, as in tracery heads, and other similar works. This is also intended to apply to mullions of windows, one side and one edge of which are to be taken as plain bed.

Sunk, Chiselled, or Rubbed Face in short lengths to hexagonal Canopies—To be measured as they occur, including arrises.

Mouldings—To be girthed the surface actually shown; the top bed, if weathered, only to be measured as sunk face.

Mouldings to Panelling—To be girthed, including the back of the panels.

Circular Face to soffit of Cusps—To be measured the whole thickness of the stone from back to front.

Circular Face to soffit of Cusps in Panelling—To be measured from the external face of the stone to the face of the panelling.

Sunk Faces to Tracery heads of Panelling—To be measured net on the face, adding the depth of the sinking from the external face.

Sunk Face in margins for Eyes—To be measured the extreme length and width.

Circular Sunk to rebated soffit of Cusps—To be measured from the external surface, adding the depth of the rebate.

Mouldings in Tracery—The extreme lengths of the straight mouldings in the tracery of the window heads

to be measured through the mitres and junctions with other mouldings.

Throat—To be measured per foot run.

Groove for Cement—Ditto.

Groove for Metal Sashes—Ditto.

Rebate not exceeding three inches girth—To be measured per foot run.

Mitres to Sinkings—To be numbered according to width.

Mitres and Returns to Sinkings—To be numbered according to the width of the sinking and length of the return.

Mitres to Mouldings—To be numbered according to the girth of the Moulding.

Mitres to long intersections of Cusped and other Mouldings—To be numbered according to the girth of the Moulding.

Mitres and returns to Mouldings—To be numbered according to girth of Moulding and length of return.

Stopped end of Mouldings—To be numbered according to girth of Moulding.

Stopped ends of Mouldings on splayed Sills and Sills of Panels—To be numbered according to the girth of the Moulding and extreme length from top of sill to point of intersection.

Rough Sinkings for cusped Window Heads and similar Sinkings—To be numbered, taking the average area of the sinking and the full thickness of the stone.

Holes punched—To be numbered according to their area and depth.

Sinkings to form Shingles—To be numbered as they occur, according to length, width, and depth of sinking.

Notchings to form Embrasures—To be numbered according to their height, width, and depth of sinking.

Water Joints—To be numbered according to their projection.

Mitres to soffits of Cusps in Tracery heads of Windows—To be numbered according to their length, and taken the full thickness of the stone.

Ditto in small Tracery heads of Panelling—To be

numbered according to their length. Measured from external face of stone to back of panelling.

Points to Cusps in Tracery heads of Windows—To be numbered according to their length, and measured the whole thickness between the sunk faces.

Ditto in small Tracery heads of Panelling—To be numbered according to their depth from sunk face to back of panelling.

Sunk and moulded œilets, each with one mitre and two long intersections—To be numbered according to extreme size.

Small Sunk Eyes—To be numbered.

Cramps out of Saw Plate—To be numbered according to length.

Cast Iron Cramps—To be numbered according to length and thickness.

Plugs—To be numbered according to length and size.

Small Copper Joggles and Mortices—To be numbered

Stone Joggles and Mortices—To be numbered.

Joggles to Vertical Joints with Pebbles in Cement—To be numbered according to size.

Pavings and Landings—To be measured per foot superficial.

Perforations to Landings—To be numbered according to size and the thickness of stone.

Slater and Slate Mason.

Measure slating to roofs by the square of 100 feet superficial; give the size and usual denomination of the slates, their gauge and the description of nails used. State if the slating is circular or upright, but make no allowance in the measurement, as the additional labour should be paid for in price.

The dimensions for slating are usually taken along the eaves in front and rear, to the extreme ends by the width from the eaves to the ridge, whether the roof is hipped or gabled.

Deduct all openings, such as chimney shafts or

dormers, but allow the run of edge around the same by 6 inches for cutting and waste.

Add for all raking edges and irregular angles the length by 6 inches, and for hips and valleys the length by 6 inches on each side.

It is usual to allow for the under course to eaves and gutters, the length by the gauge of the bottom course; on the supposition that an extra length of slate is used, which is not always the case.

Run all filleting and state if in mortar or cement.

Slate Masons' Work is usually measured by the foot superficial.

For Slate Shelves take the length by the extreme width, state the thickness, if rubbed or planed on one or both sides, and state the actual size if over 6 feet in length or 3 feet in width.

Take sawn, rubbed, filed, bevelled, or rounded edges, fillets, rebated, or grooved and tongued joints, stating if in red lead or putty, all at per foot run. Take cutting and pinning to walls at per foot run.

Number holes (according to diameter), notches, and rounded corners, stating the thickness of the slate, also the kind of screws used and the holes for the same.

Slate Skirtings and Covers to hips and ridges are taken at per foot run according to thickness and width; state if bedded in putty or red lead. Number the screws and drilling the holes for the same.

Slate Cisterns are usually numbered and described according to capacity and manner of putting together. Holes for pipes and fixing are taken extra.

CARPENTERS' WORK.

The carpenter is employed in the construction of roofs, floors, partitions, and in all those operations of building where timber is used in large scantlings. His work is generally charged by the foot cube, and the full quantity of timber used, such as tenons to framing, the bevelled ends to rafters, laps, scarfs, &c., are to be included in the measurement; deduction being only made when the part

cut out is available for other work, and, even then, it is customary to make a liberal allowance for waste in converting to use.

The labour on timber is generally classified as "Fixed only," "Framed," or "Framed and fixed."

Timber fixed includes the labour in nailing, spiking, halving, dovetailing, or notching.

Timber framed, includes morticing and tenoning.

Bond Timber, &c.

Take bond timbers, wall plates, pole plates, temptates, and lintels, under this head, at per foot cube; and add for laps, dovetails, and scarfings in the measurement.

Deduct half the length of bond timbers to door or window openings.

Floors (Naked).

Take all joists and sleepers which have not been actually framed at per foot cube, as "fixed" only.

Keep ground joists and sleepers distinct from those to upper floors.

Girders, binders, trimmers, and trimming joists are to be taken as framed.

Girders sawn down the middle, reversed and bolted, or trussed, are to be kept separate.

Take the oak trusses at per foot run. State the scantling, and if in unusual lengths. Letting in screw-bolts, plates, &c., are to be numbered as extras.

Take strutting between the joists by the foot run; state the scantling and if herring-bone or otherwise.

WOOD BRICKS.

Number the wood bricks; state the size and if cut on the splay.

Roofs.

Take King posts, Queen posts, principal rafters, and tie beams at per foot cube, as "framed in trusses."

Deduct one shoulder from the King posts and one half from the Queen posts. Allow in the length for each tenon.

Take common rafters, purlins, diagonal ties, dragging pieces, and gutter plates, except where actually framed, at per foot cube, as "fixed in rafters," &c.

Add to all iron work extra for fixing.

Take ridge, hips and valley pieces by the foot superficial, allowing for laps, and state if framed or otherwise. Measure the cuttings and waste by the foot run.

Take the slate boarding or battening by the square of 100 feet superficial; state the thickness, and at what distance the battens are apart, and their width.

Run all cuttings and bevelled edges.

Take tilting fillets to slate boarding by the foot run.

Take feather-edged eaves-boarding to slate battening by the foot run, and state the width and thickness.

Hip and ridge rolls are measured by the foot run, allowing for laps. State the diameter, and if spiked or otherwise.

Gutters and Bearers.

Measure the length of the gutter by the average width, and include half the lear boards (when the roofs are battened), state the thickness of the gutter boards, the size of the bearers, distance apart, and if framed.

Number the drips and cesspools.

When the roofs are slate boarded a fillet is used to tilt slates instead of the lear boards which should be taken by the foot run as to eaves-boarding, &c.

Trap Doors in Roof, &c.

Deduct the rafters for the opening, and add the trimmers, take the trimming rafters, &c., as framed, or allow for the extra labour in trimming the rafters.

Take the linings to the opening and the rim by the foot run, state the width and thickness of each, and if wrought, splayed, or dovetailed at the angles.

Measure the trap door by the foot superficial according to thickness, and describe as "wrought, ledged, and filleted," or as the case may be.

Take to each door a handle and bolts, according to description.

Quarter Partitions.

Take the head, sills, braces, quarters, door heads, &c., at per foot cube, and describe as "framed in trussed partitions," or otherwise, as the case may be.

Deduct for doorways, &c.

Note.—The quarters which are usually tenoned into the head and sill and spiked to the braces are to be considered as framed.

Collect the hogging pieces at per foot run, stating the width and thickness.

Iron work and fixing to be taken extra.

Ceiling Joists.

Measure ceiling joists the same as flooring joists, by the foot cube.

Take the trimming as described for the roof.

Wall Battening.

Take wall battening at per square of 100 feet superficial.

Collect the round of the walls by the height, state the thickness, width, and distance apart, also if plugged to the wall or otherwise.

Deduct all openings.

Rough Boarding.

Take rough boarding at per square of 100 feet superficial. Measure the length by the width, and where irregular take the average, allowing extra for all cutting and waste at per foot run. State the thickness of the boarding, and if edges shot, ploughed and tongued, or otherwise.

Some Surveyors take the length of all cuttings by 3 inches, which they add to the boarding for labour and waste.

Keep boarding to ceilings or walls separate as requiring more labour. Where laid to current take firrings by the foot superficial, stating the average size and distance apart.

Sound Boarding.

Take sound boarding at per square of 100 feet superficial. Measure the length by the width, including the joists, and state if on single or double fillets.

Some Surveyors, however, only take the width between the joists; therefore, whichever way it is taken should be stated so as to regulate the price.

Bracketing, &c.

Bracketing is measured by the foot superficial.

When for cornices take for the length the round of the room, deducting one projection of the cornice each way by the girth. State the thickness of deal used, and if plugged to wall, &c.

The angular brackets are taken extra and numbered.

Take bracketing to circular and groined ceilings the length by the girth, and state if the diameters are small.

Cradling for entablatures are taken at per foot superficial, according to thickness.

In all cases state if done in small quantities.

Door Frames, Solid.

Per foot cube.

Take the round of the frame, including the tenons into the head. Add 6 inches for the horns, and 2 inches for each stub to the sill.

Take the oak sill separately, the length by the width or thickness.

State if wrought, framed, rebated, and beaded, double beaded, or otherwise. State if the oak sill is wrought, framed, and weathered.

Extras—Should the sill be of stone instead of wood take iron shoes (or otherwise), and fixing to the feet of the door frame.

When the head is circular, measure the straight part as for square headed frames to the springing, and take the circular part at per foot run, stating the size and workmanship; also take the number of oak keys and wedges.

Wrought, Framed, and Rough Timbers in General.

Take wrought timbers under 3 inches square at per foot run, according to the scantling.

When timbers are large and partially wrought they are usually taken as if rough, and the labour of planing taken extra at per foot superficial, and the rebating, beading, &c., by the foot run, according to description.

Circular timbers are measured as they appear, adding the laps, scarfs, &c. The labour and waste being charged in the price.

State if a flat or quick sweep, a rise of less than half an inch on a cord line of one foot being considered a flat sweep.

When the curve is other than circular it should be stated.

State when large timbers (20 feet cube) are hoisted over 30 feet, and also when of unusual length.

Centering.

(*See Bricklayer*).

Centering to vaults is charged at per square of 100 feet superficial.

Centering to Trimmer arches, gauged and other arches over openings, when the soffit is more than 9 inches wide, are taken at per foot superficial; if under 9 inches in width, by the foot run, and describe the nature of the curve.

Take feather-edged turning pieces to trimmers at per foot run.

Fences.

Wood Fencing is generally measured by the lineal rod of 16½ feet, and charged according to description; but fancy fencing must be taken in detail.

JOINERS' WORK.

In the Joiner's work is included the fittings and decoration in wood to buildings, and his labour forms a much larger proportion to the value of the material on which he is employed than that of the Carpenter, consequently the mode of measuring and valuing is different. The Carpenter's work, as we have before stated, is for the most part measured by the cubic foot; the labour of the Joiner being spread over the surface, such a mode, under the varying circumstances of size and application, would not give the proper value, therefore, the *superficial foot*, or square of 100 feet, is adopted as the rule in estimating the value; exception only being made in very small or difficult works.

The terms "Fixed" and "Framed" admit of the same definition as in the Carpenter's trade, but a distinction is made in the measurement of the framed work by including the length of the tenons in the dimensions for the Carpenter and omitting them for the Joiner.

By the term "Flat Sweep" is to be understood a rise of half an inch on a cord line one foot long.

"Quick Sweep" is when the rise exceeds half an inch.

Flooring.

Per square of 100 *feet superficial.*

Take the length by the width, and add the pieces filled in to windows, door openings, recesses, &c.

If the room is of an irregular shape take the average size.

Measure the length of the cuttings to the rakes by a width of three inches, or as the case may be, and add to the flooring to pay for cutting and waste.

Deduct the slabs, chimney breasts, and other projections.

State the thickness, the kind of timber, width of boards, and mode of laying.

Extras—Take the glued and mitred border to slabs by the foot run.

Skirtings.

Per foot run.

Take the round of the room, and add for the passings at the angles.

State the thickness and width, if moulded or otherwise, and if backings are included.

Extras.—The number of tongued or mitred angles and housings.

Narrow Grounds.

Per foot run.

Take the length as described for the skirting.

State the thickness and width, if chamfered, plugged to wall or otherwise.

Sashes and Skylights (Fixed).

Per foot superficial.

Take the width by the height from outside to outside, and if two sashes in height allow 1 inch for the meeting rail.

State the thickness, and if the bars are square, chamfered or moulded.

Extras—Take the beads, stops, and linings by the foot run according to the thickness and width, and the labour upon them.

Sashes and Frames.

Per foot superficial.

The usual mode for ordinary frames is to take the width between the pulley stiles, adding 4 inches on each side for the frame. Take the height from the top of the sill to the under side of the head, and add 4 inches for the head and 3 inches for the sill.

State if the sill is of oak, single or double sunk, weathered or throated, the thickness of the pulley stiles, head, and linings, the size of the sash beads, thickness of the sashes and sash bars, and if moulded or otherwise; the mode of hanging the sashes, the quality of the lines, pulleys, and weights.

If the sashes have marginal lights, state whether they are perpendicular. or perpendicular and horizontal.

Extras—Number the sash fasteners according to description.

Sashes and Frames, Circular on Plan.

Per foot superficial.

Take the height by the girth, with the additions for the frame and sill, as pointed out for straight sashes and frames.

Describe the same as for straight sashes and frames, but circular on plan; state if quick sweep or flat sweep.

Extras—The same as for straight.

Sashes and Frames with Circular Heads.

Per foot superficial.

Take the lower part to the springing, the same as for square sashes and frames.

Take the circular head separately, the height by the width.

Describe as "Circular heads to sashes, and frames measured square."

Extras—The same as for square sashes and frames.

Window Linings and Window Boards.

Per foot superficial.

Take the length by the width in each case, allowing for the passings.

State the thickness of the linings, and if grooved or rounded.

For the window boards and bearers state the thickness, also if tongued to the sill and rounded on the edge.

Extras—The labour to grooves at per foot run.

Number of rounded ends to window boards.

Framed Grounds and Architraves.

Per foot superficial.

Take the round on the outside edge by the width for the grounds.

Give the thickness, and state if beaded, mitred, or back rebated.

Extras—The mouldings round the grounds up to 4 inches girth to be taken at per foot run.

Number the mitres to the mouldings.

Note—When the girth of the mouldings is over 4 inches they are to be taken at per foot superficial.

Architraves are measured on the outer edge of the moulding by the girth and charged by the foot superficial.

Shutters and Backflaps.

Per foot superficial.

Take, for the dimensions of the shutters, the height by the width, including the rebates.

Take the backflaps in the same manner, but keep them separate.

State the thickness of the shutters, the number of panels, and if hung in one or two heights, also if square framed, flush panel, moulded or otherwise.

In like manner describe the backflaps.

Extras—Hinges to the shutters and backflaps according to size.

Shutter bars according to length and description.

Holes cut for shutter bars.

Shutter knobs according to description.

Window Backs, Elbows, and Soffits.

Per foot superficial.

Take the length of the back and elbows, including the passings, by the height from the floor to the underside of the beaded capping.

Take the soffit by its extreme length and width.

State the thickness and number of panels, also if splayed, plain, keyed, square, flush panel or moulded.

Extras—Take the beaded capping to window back at per foot run.

Number the elbow caps and freeing bead according to size and description.

Back Linings.

Per foot superficial.

To the height taken for the shutters add 2 inches for that of the back lining, by the width.

State the thickness, if plain or panelled, the number of panels in height, and if square, flush or moulded, also if splayed.

Boxings.

Per foot superficial.

Take the height, including the framings, by the width.

State the thickness, and if wrought, framed, rebated, beaded, or splayed; if all, they are termed "proper boxings."

Sliding Shutters.

Per foot superficial.

Take the height by the width.

State the thickness, number of panels, the mode of framing, &c., and in how many heights they are hung; give the size of the pulley pieces and beads, the quality of the line, weights, and pulleys.

Extras—Take the run of groove for the beads.

Take the run of flap to cover the shutters when down, according to thickness and description.

The boxings, grounds, &c., to be taken as for window fronts.

Take the fastenings, and flush rings to the shutters. and hinges to the flap.

Outside Shutters.

Per foot superficial.

Take the height by the width, including the rebates (if folding).

State the thickness, number of panels to each fold, the mode of framing, and give a description of the mouldings.

Extras—Take the hanging stile at per foot run, according to size.

Hinges, rings, and turn buckles, according to size and description.

Gates, Framed.

Per foot superficial.

Take the height by the width, including the rebates (if hung folding).

State the thickness of the gate, and how framed and hung.

Extras—Take the run of capping, according to description.

Number the wicket extra for forming, fitting, and hanging.

Take hinges, bolts, locks, latches, swing bar, or other fastenings, and iron lining to sill.

Stay hooks, and eyes, and fixing.

Doors Ledged.

Per foot superficial.

Take the height by the width, including the rebates, if hung folding.

State the thickness of the door and size of the ledges, and whether wrought, ploughed, tongued and beaded; if all, they are termed "proper ledged doors," also state if braced.

Extras—Take the hinges, locks, latches, and bolts, according to the usual description.

Doors Framed or Panelled.

Per foot superficial.

Take the height by the width, and if folding include the rebates.

Give the thickness of the door, and the number of panels, as stated for shutters, and *state* if moulded, &c.

Extras—Hinges, locks, bolts, knobs, &c.

Note—Circular heads are to be taken separately, and measured square from the springing.

Jamb Linings.

Per foot superficial.

The length of the jamb linings is usually collected by adding twice the height of the sides to the width of the door, *plus* four times the thickness of the jamb linings.

State the thickness, if tongued to frames, if single or double rebated, if beaded on both edges, and if framed in panels (with the description and number).

Extras—The number of dovetailed or other blockings to receive the hinges and lock.

Door Grounds Framed.

Per foot superficial.

Take the length by the width.

To find the length take that found for the door jambs, and add for the passings at the angles four times the width of the ground.

State the thickness, and describe according to the amount of labour.

Extras—Take the mouldings round the grounds, or the architrave with the extras, as described for window fronts.

Staircases (Flyers).

Take the extreme length of the tread, including the housings into the strings, by the collected widths and heights of the treads and risers, measured from the front of the riser to the nose of the tread for one, and from tread to tread for the other, as in the sketch.

State the thickness of the treads and risers, with the number and sizes of the carriages (if any).

State if the steps are wrought, glued, or blocked, if with moulded or rounded nosing, if cut and mitred to string, or housed to string, at one or both ends, as the case may be.

Extras—Take the bottom step separately, if longer, or with curtail end.

Take grooving and tongueing by the foot run; also take the run of nosing on the floor to form the upper steps.

Take housings to the steps and risers.

Dovetailed sinkings for balusters.

Number of returned moulded nosings.

Number of cut brackets, according to description.

The curtail end to bottom step, according to description.

Take all fascias, apron linings, by the foot superficial, according to description.

Staircases (Winders).

Per foot superficial.

Take the whole of the space occupied by the winders. Collect the lengths of the risers by the height, plus 1 inch for each nosing on the winders.

State the thickness, &c., as pointed out for the flyers.

Extras—Take the grooving and tongueing by the foot run.

Number the housings to the winders, and keep them separate from those of the flyers; also the returned circular nosings to the steps, and the number of circular cut brackets.

String Boards.

Per foot superficial.

Take the extreme length, including the framings, &c., by the width, keep the parts that are wreathed separate.

Note—Wall strings are usually assumed as 12 inches wide.

State the thickness of the strings, if framed, rebated, and beaded, if sunk or double sunk, if moulded, if cut and mitred to risers, also if solid wreathed, or wreathed in thicknesses, or cylindrical mould with proper backings

State if the circular parts are under 6 inches radius.

Extras—Number of ramps (extra to the measurement)

,, tongued angles.

,, housings.

,, splayed ends.

Handrails.

Per foot run.

Take the length along the middle of the rail. Keep separate the parts that are straight, ramped, wreathed and circular.

State the thickness, if moulded or otherwise, and if the circular or wreathed parts are to well holes of less than 12 inches opening, it must be stated.

Extras—Sinking for iron cores, straight or circular at per foot run.

Number of handrail screws and fixing.

Number of scroll ends or moulded caps to newel.

Screw nut and joint to cap, &c.

Newels.

Per foot run.

Take the height, including the tenons.

State the size, and if single or double, turned or otherwise.

Extras—Number of turned pendants.

Iron screw, bolt, and fixing.

Balusters.

Per foot run.

Take the height, including the tenons, if framed.

State the size, if square or otherwise, if nailed on one or both ends, or dovetailed.

Extras—Iron balusters if used instead of wood, and take the number of screws and fixing.

Fittings to Water-closets.

Per foot superficial.

For the seat and riser, take the extreme length and width of the seat, to which add the height of the riser.

For the flap and frame, take the length and width.

State the thickness of the seat and riser, say if made

to shift; and also the thickness and labour on the flap and frame.

Extras—Take the skirting round the seat at per foot run according to width and thickness, also the rounded corners.

Take the moulded nosing under the flap at per foot run, and state if tongued.

Take the hinges, according to description.

The holes for the handle, stating if with mitred bead round the same.

Take the hole for the pan, and state if properly dished.

PLASTERERS' WORK.

Plasterers' work is usually charged by the yard superficial.

Rendering to Walls.

Take the length of the walls by the height, from the top of the skirting grounds to the ceiling; deduct for the doors, windows, &c., and half the depth of the cornice; if the cornice is bracketed, deduct the whole.

State the number of coats, if in mortar or cement, if set, floated and set, or as the case may be.

Take the run of beads or quirks extra.

Lath and Plaster to Ceilings.

Take the dimensions from wall to wall, deduct the cornice at one side and end only. If the cornices are bracketed, deduct the whole.

State the number of coats, if floated or set, or both, and if with putty.

State if single, lath and half, or double laths are used.

Take friezes, soffits, &c., according to description, by the foot superficial.

Measure raised panels extra by the foot superficial.

Take the mouldings on the panel by the foot run, according to the girth, and number the mitres.

Number pateras and other ornamental work, giving a full description of each.

Lath and Plaster Work to Partitions.

Measure as described for Rendering. If a cornice, deduct one-third of the depth, or if bracketed deduct the whole; give description as directed for ceilings.

Cornices.

Take the length round the wall, and deduct one projection of the cornice each way, for the mean length. If the girth of the moulding from the ceiling to the wall line is under 6 inches, take it by the foot run, stating the actual girth, and if over 6 inches, take it by the foot superficial.

If there are coves to the cornices take them by the foot superficial.

Take enrichments by the foot run, stating the girth, and if undercut.

Number all the mitres to angles above four, stopped ends, &c., stating the girth, and whether the mitres are internal or external.

Stucco.

Take stucco work by the yard superficial; state if bastard, trowelled, on laths, or bricks, or as the case may be.

Take reveals and narrow widths by the foot run.

Take quirks, arrises, and beads by the foot run.

Skirting.

Take cement skirting by the foot run, stating the width, and how finished.

Number the angles.

Colouring, Limewhiting, &c.

Take colouring and limewhiting by the yard superficial, according to description.

Take the run of cornices and describe the girth.

Note—If any of the foregoing work is circular it must be stated, and the circular parts kept separate.

SMITH AND FOUNDERS' WORK.

Iron work is usually charged by weight, and the dimensions are to be taken with this view. It does not matter by what method the Surveyor proceeds with the measurement, if he obtains the exact contents in feet or inches.

Keep each article separate, according to description.

Cast Iron—Take a pattern for each description of article of cast iron.

Take chipping, filing, and fitting extra by the foot run.

Wrought Iron—Measure by the foot superficial, according to thickness, and reduce to weight in the abstract.

Take the number of holes drilled for bolts, rivets, or otherwise, according to the thickness of the iron.

Number the bolts when small, and the rivets according to size.

Note—As all articles of cast and wrought iron are sold by weight, it is desirable to give the weight when practicable.

PLUMBERS' WORK.

In measuring lead the dimensions should be carefully taken, the material being heavy and expensive, and small errors in the superficial dimensions become serious when reduced to weight.

Lead, including the labour of laying to gutters, flats, and flashings, is usually charged by the cwt., and under one head.

Take leadwork to cesspools, cisterns, sinks, &c., in the same manner as for gutters, &c., but separate.

Take soldering to joints, angles, &c., and nailing extra at per foot run.

Take pipes at per foot run, according to the diameter and weight, take the joints extra.

Number all cocks and fixing according to size. Give an accurate description of each. State if with spanners or keys.

Take plugs, washers, and wastes, air-traps, gratings,

screw, or driving ferrules, &c., and fixing, according to description and size.

Give an accurate description of each water-closet, the traps, and mode of fixing, &c.

Take making good to soil and other pipes extra.

Pumps and fixing are taken at so much each.

Take the suction, and supply pipes, and making good the same to the pumps, also wall hooks and fixing extra.

PAINTERS', GLAZIERS', AND PAPERHANGERS' WORK.

PAINTER—The rule observed in measuring Painters' work is to take wherever the brush goes, and to charge by the superficial yard, except where it becomes necessary to work to a line, as in the case of skirtings, to prevent the floor or wall from being soiled, technically termed "cut in on both edges."

In describing painters' work state the number of oils, if knotted, or stopped, flatted or otherwise, if in common or ornamental colours. If the latter give the name of each.

Note—Common colours are produced from the mixture of lampblack, red lead, venetian red, English or Turkey umber, Spanish brown, or any of the common ochres with white lead and oil.

The ornamental colours are Prussian blue, indigo, mineral green, the rich reds, pinks, and yellow.

Take skirting, handrail, iron bar, rain water pipe, edges to shelves, edges of coping, stone strings, cornices, &c., by the foot run.

Note—Strings, cornices, or other work, when done from a ladder or scaffold, should be kept separate.

Number sash frames (the outside only).

Sash squares (each side) per dozen.

Window sills, chimney pieces, newels, ballusters, heads and shoes to rain water pipes, door scrapers, brackets, shutter bars, bolts, &c., each.

Note—Take the inside of the sash frames with the linings at per foot superficial.

Work difficult to be measured, such as the capitals to columns and other ornamental work, should be numbered and described, to give as clear an idea of the amount of labour upon them as possible.

Letters or figures are numbered according to the height of each in inches, and described as plain or ornamental.

GLAZIER—In measuring glass take the dimensions from rebate to rebate each way, when the panes are square, if irregular or circular take the extreme dimensions as if they were square; keep large squares separate.

Describe the glass as stopped into old or new sashes, and according to the quality.

Cleaning windows, including breakage, is usually charged by the dozen squares, each side being numbered, and large squares kept separate.

It is frequently the practice with Surveyors to allow one-eighth of the superficial quantity of painting for edges, instead of measuring them, which admits of the quantity being obtained from the joiners' bill.

PAPERHANGER—Paper for walls and hanging is charged by the piece of 12 yards long and 20 inches wide.

Find the surface of the walls in feet, and divide by 5, for the number of yards run of paper, which again divided by 12, or by 60 in one operation, will give the number of pieces.

Odd yards are charged as one piece.

Take in the same manner and charge extra at per piece:

Pummicing and preparing the walls.
Lining paper and hanging the same.
Take borders and hanging at per dozen yards run.

GASFITTERS' WORK.

Take gas pipes, including fitting and fixing, by the foot run, according to size.

Take the number of elbows, crosses, T pieces, reducing sockets, outlets, &c., extra.

Take the metre, governors, syphon traps, pendants, &c., and fixing, according to description.

Opening the ground and filling in is taken at per foot run, according to depth.

Holes broken through walls and made good, are numbered according to the thickness of the wall.

ABSTRACTING THE DIMENSIONS.

The several items after the dimensions have been squared and checked are to be abstracted as follows:

Take the trades according to order, thus:

Excavator.
Bricklayer.
Mason.
Slater.
Carpenter and Joiner.
Smith.
Plasterer.
Plumber.
Glazier.
Painter.
Gasfitter.

In each trade take—

1. The cubic quantities, commencing with the highest denomination. and the items of each according to value; those of least value first.

2. The superficial quantities according to denomination and value.

3. The lineal quantities according to denomination and value.

Lastly. The numbers according to value.

N.B.—Those items which include labour only should be kept distinct from those which include both labour and materials.

MEMORANDA CONNECTED WITH BUILDERS' WORK.

EXCAVATOR.

EARTH and CLAY increase in bulk about *one-fourth* when dug, but subside *one-fifth* in height, and decrease *one-sixth* in bulk when formed into embankments.

SAND and GRAVEL increase *one-twelfth* when dug. Sand subsides in embankments *one-fourth* in height, and Gravel from *one-tenth* to *one-twentieth*, according to its coarseness.

Sand and Gravel decrease very slightly in bulk after being formed into embankments. The former, however is liable to be washed away by rain, unless protected.

CHALK increases about *one-third* of its original bulk when excavated.

ROCK increases about *one-half* of its original bulk when excavated.

Clean dry SAND and GRAVEL in excavation will retain a vertical face for a short time without falling in	= 0 to 1 foot.
Ditto MOIST SAND and ordinary SURFACE MOULD	= 1 to 3 feet.
Ditto LOAMY SOIL well drained . .	= 5 to 10 "
Ditto CLAY well drained	= 9 to 12 "
ORDINARY EARTH or CLAY will stand for a short time in embankments at a slope of	1 to 1
If well drained it will stand permanently at a slope of	$1\frac{1}{2}$ to 1
If imperfectly drained it will stand at a slope of	2 to 1

CHALK and ROCK will stand vertically.

A LOAD equals 1 cubic yard of 27 cubic feet or 21 striked bushels.

An ORDINARY CART 6 feet long by $3\frac{1}{4}$ feet wide. and $2\frac{1}{3}$ feet deep will hold 45 cubic feet, or about $2\frac{1}{2}$ tons of earth or night soil.

A DOBBIN CART will hold about		$\frac{3}{4}$	yard cube.
An EARTH WAGON, small, will hold		$1\frac{1}{2}$	"
" large	"	3	"
A WHEEL BARROW	"	$\frac{1}{10}$	"

Earth cannot be wheeled in BARROWS economically to a greater distance than 100 yards.

A HORSE RUN cannot be used economically for a less depth than 20 feet.

THE QUANTITY OF EXCAVATION IN WELLS AND CIRCULAR SHAFTS FOR EACH FOOT IN DEPTH.

Diameter of Excavation.		Quantity.	Diameter of Excavation.		Quantity.
ft.	in.	Cubic yards.	ft.	in.	Cubic yards.
3	0	.2618	6	6	1.2290
3	3	.3072	6	9	1.3254
3	6	.3563	7	0	1.4254
3	9	.4091	7	3	1.5290
4	0	.4654	7	6	1.6362
4	3	.5254	7	9	1.7472
4	6	.5890	8	0	1.8617
4	9	.6563	8	6	2.1017
5	0	.7272	9	0	2.3562
5	3	.8018	9	6	2.6253
5	6	.8799	10	0	2.9089
5	9	.9617	10	6	3.2070
6	0	1.0472	11	0	3.5198
6	3	1.1363	12	0	4.1888

CONCRETE is usually formed of 1 part lime, 2 parts sand, and 5 parts of broken stone or shingle.

Where Thames ballast or gravel containing sand is used, the proportions are 1 part of lime and 7 parts of ballast, &c.

The lime and ballast, &c., lose about $\frac{1}{5}$th of their bulk when made into concrete.

An expansion takes place in concrete during the slaking of the lime, to the extent of about $\frac{3}{8}$ths of an inch to every foot in height, which it retains permanently.

PILES from 10 to 14 inches square require to be driven with a monkey weighing from 12 to 18 cwt. according to length.

SHEET PILES 3 in. × 9 in. can be driven with a monkey weighing from 5 to 8 cwt

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BRICKLAYER.

1 Rod of Brickwork measures $16\frac{1}{2}$ ft. × $16\frac{1}{2}$ft. × $1\frac{1}{8}$ ft. = 306 cubic feet.

1 Rod of Brickwork = $11\frac{1}{3}$ cubic yards.

1 Rod of Brickwork = 272 superficial of the standard thickness of $13\frac{1}{2}$ inches.

To reduce Brickwork from cubic feet to superficial feet of the standard thickness, deduct $\frac{1}{9}$th.

To reduce Brickwork from superficial feet of 9 inches thick to the standard thickness of $13\frac{1}{2}$ inches, deduct $\frac{1}{3}$rd.

1 Superficial Foot of reduced brickwork		requires	16 Bricks
,, ,,	Facing	,,	7 ,,
,, ,,	Gauged Arches	,,	10 ,,

1 Rod of Brickwork laid dry in Wells, &c., including waste		4800 Stocks.
,, ,,	Walls, &c.	4700 ,,
,,	in mortar (average)	4300 ,,
,,	laid dry ,,	5000 ,, place
,,	in mortar ,,	4500 ,, ,,

64 Cubic Feet of Clay is required to manufacture 1000 Bricks.

The Proportion of Stock Bricks and Mortar to a Rod of Brickwork.

Thickness of Mortar Joints.	Gauge or Height of 4 Courses.	Cubic Feet of Bricks.	Cubic Feet of Mortar.	Number of Bricks.
inch.				
$\frac{1}{4}$	$12\frac{1}{2}$	258	58	4180
	12	257	59	4350
	$11\frac{1}{2}$	256	60	4540
$\frac{3}{8}$	$12\frac{1}{2}$	237	79	4010
	12	236	80	4176
	$11\frac{1}{2}$	234	82	4358

1000 Bricks closely stacked occupy about 56 cubic feet.

1000 Old Bricks cleaned and loosely stacked occupy about 72 cubic feet.

Bricks absorb about $\frac{1}{15}$ of their weight of water.

A Bricklayer's Hod measures 16 in. × 9 in. × 9 in. =1296 cubic inches.

Ditto will hold 20 bricks.

Ditto, ditto $\frac{2}{3}$ cubic foot of mortar.

Ditto, ditto $\frac{1}{2}$ bushel nearly.

The proportions of Lime, Sand, or Cement required for a Rod of Brickwork are:

Of Plymouth Stone Lime . .	26	Cubic Feet.
Sand	78	
Petersfield, Lewes, or Dorking Grey Chalk Lime	36	”
Sand	72	
Blue Lias Lime	38	”
Sand	77	
Roman or Portland Cement . .	45	”
Sand	45	

1 Rod of Brickwork requires 126 gallons of water to slake the lime and mix the mortar.

A Load of Mortar=1 cubic yard, and will fill 30 hods.

	Mortar produced in cubic feet.
1 Imperial Bushel of Blue Lias Lime unslacked weighing 70lbs. . . . . 2 Imperial Bushels of Sand weighing 103 lbs. $6\frac{1}{2}$ Gallons of Water	2.75
1 Imperial Bushel of Blue Lias Lime unslacked 3 " Sand . . . . $7\frac{1}{2}$ Gallons of Water	3.25
1 Imperial Bushel of Portland Cement, weighing 99 lbs. . . . . 1 Imperial Bushel of Sand weighing 103 lbs. . $3\frac{3}{4}$ Gallons of Water	1.75
1 Imperial Bushel of Portland Cement . . . 2 " Sand . . . . $5\frac{1}{4}$ Gallons of Water	2.58
1 Imperial Bushel of Portland Cement . . 3 " Sand . . . . $6\frac{3}{4}$ Gallons of Water	3.42
1 Imperial Bushel of Roman Cement, weighing 72 lbs. . . . . $9\frac{1}{2}$ Gallons of Water	1.125

Note—The mortar produced weighed 106 lbs.

1 Imperial Bushel of Roman Cement . . . " Sand (103 lbs.) . . . $9\frac{1}{2}$ Gallons of Water	1.764

Note—The mortar weighed 196 lbs.

	Concrete produced in cubic feet.
1 Imperial Bushel of Portland Cement . . 1 " Stone broken small . . $\frac{1}{2}$ " Sand . . . . $4\frac{1}{8}$ Gallons of Water	2·08

Lime and sand, and cement and sand lose about one third of their bulk when made into mortar.

Lime, or Portland cement, and sand require to mix into mortar about one third of their bulk of water.

Brick nogging requires—

Per yard superficial .	45 Stock bricks laid flat.
" .	30 " on edge.
" .	$\frac{3}{4}$ cubic foot mortar when flat
" .	$\frac{1}{2}$ " " on edge.

THE NUMBER OF BRICKS AND QUANTITY OF BRICK-WORK IN WELLS AND CYLINDRICAL SEWERS FOR EACH FOOT IN DEPTH OR LENGTH.

	Half-Brick Thick.			One Brick Thick.		
	Number of Bricks.			Number of Bricks.		
	Laid Dry.	Laid in Mortar.	Cubic feet of Brick-work.	Laid Dry.	Laid in Mortar.	Cubic feet of Brick-work.
1.0	28	23	1.6198	70	58	4.1233
1.3	33	27	1.8145	80	66	4.7124
1.6	38	31	2.2089	90	74	5.3015
1.9	43	35	2.5035	102	82	5.8905
2.0	48	41	2.7979	112	92	6.4795
2.3	53	44	3.0926	122	100	7.0686
2.6	58	48	3.3870	132	108	7.6577
3.0	68	57	3.9760	154	126	8.8357
3.6	79	65	4.5651	174	142	10.0139
4.0	89	73	5.1541	194	159	11.1919
4.6	100	82	5.7432	214	176	12.3701
5.0	110	90	6.3322	234	192	13.5481
5.6	120	98	6.9213	254	209	14.7263
6.0	130	107	7.5103	276	226	15.9043
6.6	140	115	8.0994	296	242	17.0825
7.0	150	123	8.6884	316	260	18.2605
7.6	160	131	9.2775	336	276	19.4387
8.0	170	140	9.8665	358	292	20.6167
8.6	180	148	10.4556	378	308	21.7949
9.0	191	156	11.0446	398	326	22.9729
10.0	212	174	12.2227	438	360	25.3291

Paving requires—

Per yard superficial	36	Stock bricks laid flat.
,,	52	,, on edge.
,,	36	Paving bricks laid flat.
,,	92	,, on edge.
,,	13	Tiles, 10 inch.
,,	9	,, 12 inch.
,,	125	Clinkers laid flat.
,,	143	,, on edge.
,,	136	,, herring bone.

Pointing Brickwork requires—

Per yard superficial	Flat joint	$\frac{1}{5}$ cubic foot mortar.
,,	Tuck	$\frac{1}{8}$,, putty.
		$\frac{1}{8}$,, mortar.

A plain tile measures $10\frac{1}{2}$ in. $\times$ $6\frac{1}{2}$ in. $\times$ $\frac{5}{8}$ in. and weighs about $2\frac{1}{2}$ lbs.

A pantile measures $13\frac{1}{2}$ in. $\times$ $9\frac{1}{2}$ in. $\times$ $\frac{1}{2}$ in., and weighs about $5\frac{1}{4}$ lbs.

Tiling requires—

Per square of 100 ft. super.	4 in. gauge	600	Plain tiles.
,, ,,	$3\frac{1}{2}$,,	700	,,
,, ,,	3 ,,	800	,,
,, ,,	10 ,,	180	Pantiles.
,, ,,	11 ,,	164	,,
,, ,,	12 ,,	150	,,

1 square of plain tiling weighs, on the average, 15 cwt.
,, pantiling ,, 8 ,,
A plain tile lath is $1\frac{1}{4}$ inch wide and a $\frac{1}{4}$ inch thick.
A pantile lath is $1\frac{1}{2}$ inch wide and 1 inch thick.
100 plain tile laths 5 feet long=1 bundle.
12 pantile laths 10 feet long=1 bundle.

$$\left.\begin{array}{l}\text{1 bundle of laths}\\ 1\frac{1}{2}\text{ hundred of nails}\\ \text{1 peck of tile pins}\\ \text{3 hods of mortar}\end{array}\right\}\text{to 1 square of plain tiling.}$$

$$\left.\begin{array}{l}\text{1 bundle of laths}\\ 1\frac{1}{4}\text{ hundred of nails}\end{array}\right\}\text{to 1 square of pantiling.}$$

Table Showing the Value of Brickwork per Rod, according to the Price of Bricks, &c.

Price of Bricks per Thousand.	Cost of Labour and Mortar per Rod.							
	65*s.*	70*s.*	75*s.*	80*s.*	85*s.*	90*s.*	95*s.*	100*s.*
s.	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*
20	7 15 0	8 0 0	8 5 0	8 10 0	8 15 0	9 0 0	9 5 0	9 10 0
21	7 19 6	8 4 6	8 9 6	8 14 6	8 19 6	9 4 6	9 9 6	9 14 6
22	8 4 0	8 9 0	8 14 0	8 19 0	9 4 0	9 9 0	9 14 0	9 19 0
23	8 8 6	8 13 6	8 18 6	9 3 6	9 8 6	9 13 6	9 18 6	10 3 6
24	8 13 0	8 18 0	9 3 0	9 8 0	9 13 0	9 18 0	10 3 0	10 8 0
25	8 17 6	9 2 6	9 7 6	9 12 6	9 17 6	10 2 6	10 7 6	10 12 6
26	9 2 0	9 7 0	9 12 0	9 17 0	10 2 0	10 7 0	10 12 0	10 17 0
27	9 6 6	9 11 6	9 16 6	10 1 6	10 6 6	10 11 6	10 16 6	11 1 6
28	9 11 0	9 16 0	10 1 0	10 6 0	10 11 0	10 16 0	11 1 0	11 6 0
29	9 15 6	10 0 6	10 5 6	10 10 6	10 15 6	11 0 6	11 5 6	11 10 6
30	10 0 0	10 5 0	10 10 0	10 15 0	11 0 0	11 5 0	11 10 0	11 15 0
31	10 4 6	10 9 6	10 14 6	10 19 6	11 4 6	11 9 6	11 14 6	11 19 6
32	10 9 0	10 14 0	10 19 0	11 4 0	11 9 0	11 14 0	11 19 0	12 4 0
33	10 13 6	10 18 6	10 3 6	11 8 6	11 13 6	11 18 6	12 3 6	12 8 6
34	10 18 0	11 3 0	11 8 0	11 13 0	11 18 0	12 3 0	12 8 0	12 13 0
35	11 2 6	11 7 6	11 12 6	11 17 6	12 2 6	12 7 6	12 12 6	12 17 6
36	11 7 0	11 12 0	11 17 0	12 2 0	12 7 0	12 12 0	12 17 0	13 2 0
37	11 11 6	11 16 6	12 1 6	12 6 6	12 11 6	12 16 6	13 1 6	13 6 6
38	11 16 0	12 1 0	12 6 0	12 11 0	12 16 0	13 1 0	13 6 0	13 11 0
39	12 0 6	12 5 6	12 10 6	12 15 6	13 0 6	13 5 6	13 10 6	13 15 6
40	12 5 0	12 10 0	12 15 0	13 0 0	13 5 0	13 10 0	13 15 0	14 0 0

Table Showing the Value of Brickwork, &c., according to the Rate per Cubic Foot.

Price per Cubic Ft.	Price per Yard Sup. 4½-inch thick.		Price per Cubic Yard.			Price per Rod.			Price per Cubic Ft.	Price per Yard Sup. 4½ inch thick.		Price per Cubic Yard.			Price per Rod.		
d.	s.	d.	£	s.	d.	£	s.	d.	d.	s.	d.	£	s.	d.	£	s.	d.
¼	0	0.844	0	0	6¾	0	6	4½	6¾	1	10.781	0	15	2¼	8	7	6½
½	0	1.687	0	1	1½	0	12	9	7	1	11.625	0	15	9	8	19	6
¾	0	2.431	0	1	8¼	0	19	1½	7¼	2	0.469	0	16	3¾	9	5	4½
1	0	3.375	0	2	3	1	5	6	7½	2	1.313	0	16	10½	9	11	3
1¼	0	4.219	0	2	9¾	1	11	10½	7¾	2	2.156	0	17	5¼	9	17	7½
1½	0	5.062	0	3	4½	1	18	3	8	2	3.000	0	18	0	10	4	0
1¾	0	5.906	0	3	11¼	2	4	7½	8¼	2	3.844	0	18	6¾	10	10	4½
2	0	6.750	0	4	6	2	11	0	8½	2	4.688	0	19	1½	10	16	9
2¼	0	7.594	0	5	0¾	2	17	4½	8¾	2	5.531	0	19	8¼	11	3	1½
2½	0	8.438	0	5	7½	3	3	9	9	2	6.375	1	0	3	11	9	6
2¾	0	9.281	0	6	2¼	3	10	1½	9¼	2	7.219	1	0	9¾	11	15	10½
3	0	10.125	0	6	9	3	16	6	9½	2	8.063	1	1	4½	12	2	3
3¼	0	10.969	0	7	3¾	4	2	10½	9¾	2	8.806	1	2	0¼	12	8	7½
3½	0	11.813	0	7	10½	4	9	3	10	2	9.750	1	2	6	12	15	0
3¾	1	0.656	0	8	5¼	4	15	7½	10½	2	11.438	1	3	7½	13	7	9
4	1	1.500	0	9	0	5	2	0	11	3	1.125	1	4	9	14	0	6
4¼	1	2.344	0	9	6¾	5	8	4½	11½	3	2.813	1	5	10½	14	13	3
4½	1	3.188	0	10	1½	5	14	9	12	3	4.500	1	7	0	15	6	0
4¾	1	4.031	0	10	8¼	6	1	1½	12½	3	6.188	1	8	1½	15	18	9
5	1	4.875	0	11	3	6	7	6	13	3	7.875	1	9	3	16	11	6
5¼	1	5.719	0	11	9¾	6	13	10½	13½	3	9.563	1	10	4½	17	4	3
5½	1	6.563	0	12	4½	7	0	3	14	3	11.250	1	11	6	17	17	0
5¾	1	7.406	0	12	11¼	7	6	7½	15	4	2.625	1	13	9	19	2	6
6	1	8.250	0	13	6	7	13	0	16	4	6.000	1	16	0	20	8	0
6¼	1	9.094	0	14	0¾	7	19	4½	17	4	9.375	1	18	3	21	13	6
6½	1	9.938	0	14	7½	8	5	9	18	5	0.750	2	0	6	22	19	0

MASON, &c.

A quarryman will be able to turn out from five to eight tons of stone per day.

100 cubic feet of SOLID STONE when broken to pass through a ring $1\frac{1}{2}$ inches diameter will = 190 cubic feet.

Ditto	2	"	= 182	"
Ditto	$2\frac{1}{2}$	"	= 170	"

ASHLAR MASONRY requires about one-eighth of its volume of mortar.

RUBBLE MASONRY requires for each cubic yard $1\frac{1}{5}$ cubic yard of stone and $\frac{1}{4}$ cubic yard of mortar.

M. BRARD'S TEST FOR THE EFFECTS OF FROST OR "SALTPETERING" ON BUILDING STONE OR BRICK.

Take a piece of the stone or brick about two inches square and suspend it during thirty minutes in a saturated solution of sulphate of soda kept at the boiling point.

The piece is then to be carefully withdrawn, the liquid decanted free from sediment into a flat vessel, and the stone, &c., to be suspended over it in a cool cellar.

When the salt effloresces on the surface of the stone it must be again dipped into the liquid, and the process should be repeated once or twice during each day, for about a week. At the end of which time the earthy sediment found at the bottom of the vessel is to be weighed, and the *quantity* will give an indication of the like effect from frost, or the more destructive action of "saltpetering."

TABLE SHOWING THE SIZES OF SLATES AND THE PROPORTIONS USED IN ROOFING.

Name of Slate.	Size.	Gauge.	Number of Squares Covered by 1200.	Number required to cover 1 Square.	Nails required per Square.	
					Iron, Number.	Copper, lbs.
	In. In.	Inches.				
Doubles	12 × 8	4½	2.8	430	430	5
Ditto	13 × 6	5	2.5	480	480	5¼
Ladies	14 × 12	5½	5.0	240	280	3¼
Ditto	15 × 8	6	4.0	300	300	3½
Viscountesses ...	18 × 10	7½	6.0	200	200	2¾
Countesses.........	20 × 10	8½	7.0	171	342	4
Marchionesses ...	22 × 12	9½	9.4	130	260	3¼
Duchesses	24 × 12	10½	10	125	250	3
			Covered by 1 Ton.			
Imperial...........	30 × 24	13½	2.5	48	96	3
Rags.................	36 × 24	16½	2.2	40	80	3
Queens	36 × 24	16½	2.5	40	80	2½

CARPENTER.

40	cubic feet of unhewn timber		1 load.
50	" squared "		
600	superficial ft. of 1 in. planks or deals		
400	" $1\frac{1}{2}$ "		
300	" 2 "		
240	" $2\frac{1}{2}$ "		
200	" 3 "		
170	" $3\frac{1}{2}$ "		
150	" 4 "		

120 Deals = 1 hundred.

Battens are 7 inches wide.
Deals " 9 "
Planks " 11 "

One square of flooring requires—

		No.
12 feet Deal boards, rough		$12\frac{1}{4}$
"	edges shot	$12\frac{1}{2}$
"	wrought and laid folding	13
"	wrought and laid straight joint	$13\frac{1}{2}$
"	wrought, ploughed, and tongued	14
12 feet battens, rough		16
"	edges shot	$16\frac{1}{2}$
"	wrought and laid folding	17
"	wrought and laid straight joint	18

Waste on Timber—

In sawing . . . . . . $\frac{1}{10}$th of the volume.
" and edges shot $\frac{1}{8}$th "

An allowance of *one-half* is usually made for waste on scaffolding, centering, &c., on reconverting to use.

White deal, as purchased at the yard, shrinks about $\frac{1}{70}$th part on becoming perfectly dry.

What are termed "dry deals" shrink about $\frac{1}{90}$th part.

If the depth of piece of timber does not exceed $\frac{1}{120}$th part of its length it may be bent into a curve that will rise about $\frac{1}{8}$th of the span without impairing its elastic force.

Table Showing the Uses to which the Various Timbers are Best Adapted.

General Construction.

Oak	Chesnut	Teak	Cedar
Fir	Elm	Walnut	Larch
Pine	Beech	Mahogany	Poplar

Durable in Wet Works.

Oak	Alder	Larch
Elm	White Cedar	Plane (N. American)
Beech	Teak	Acacia

Durable in Dry Works.

Oak	Olive	Alder
Deal	Pine	Ash
Poplar	Walnut	Sycamore
Chesnut	Mahogany	Willow
Cedar	Maple	Cypress
Teak	Larch	Hornbeam

Patterns for Ironwork.

Deal	Pine
Alder	Mahogany

The Various Modes in Use for Preserving Timber.

Kyanizing.

The timber is immersed in a saturated solution of corrosive sublimate in a wooden tank, put together so that no metal of any kind can come in contact with the solution.

One pound of corrosive sublimate to ten gallons of water is used when a maximum strength is required, and one pound to fifteen gallons of water when a minimum, according to the porosity of the timber; with the latter proportion, one and a half pounds will be sufficient for a load of timber of fifty cubic feet.

Corrosive sublimate dissolves best in tepid water.

The time required to saturate the timber depends on its thickness; twenty-four hours are usually allowed for each inch in thickness for boards and small timber; large timber requires from a fortnight to three weeks.

Burnettizing.

A solution of one pound of chloride of zinc to four gallons of water for timber, and one pound to five gallons for canvas, cordage, &c., in a wooden tank.

Timber requires to be immersed for about two days for each inch in thickness, and afterwards taken out and left to dry for about fourteen to ninety days.

Canvas, ropes, &c., require to be immersed in the solution for about forty-eight hours, then taken out and dried.

The process on wood may be more expeditiously performed by means of the hydraulic press.

Bethel's Process.

Bethel's method of preserving timber consists in impregnating its pores with creosote. The cost is estimated to be from ten to fifteen shillings per load.

Payne's Process.

Is impregnating the wood with a strong solution of sulphate of iron, and afterwards forcing into the timber a solution of any of the carbonate alkalies, by which means the oxide of iron becomes insoluble.

PLASTERER.

1 Cask of Portland Cement=4 Bushels (nominally).
" Roman " =5 " "

Note—The contents of Cement casks vary from 3.75 to 3.85 cubic feet, but by pressure they are made to hold $3\frac{1}{2}$ bushels, and the weight exclusive of tare is

THE NUMBER OF SUPERFICIAL YARDS OF RENDERING PERFORMED WITH A BUSHEL OF PORTLAND CEMENT AND VARIOUS PROPORTIONS OF SAND.

Proportions.	Thickness in inches.				
	½	⅝	¾	⅞	1
1 Bushel Cement	2.8	2.4	2.1	1.7	1.4
" and 1 sand	4.6	4.0	3.4	2.8	2.3
" 2 "	6.8	5.9	5.1	4.2	3.4
" 3 "	9.0	7.9	6.7	5.6	4.5

THE QUANTITY OF MATERIALS USED IN PLASTERING, FOR EACH SUPERFICIAL YARD.

Rendering only .	Lime	. .	.34	cubic feet.
	Sand	. .	.50	"
	Hair	. .	.15	lbs.
	Water	. .	1.70	gallons.
Render 1 coat and set	Lime	. .	.50	cubic feet.
	Sand	. .	.50	"
	Hair	. .	.18	lbs.
	Water	. .	2.00	gallons.
Render 2 coats and set	Lime	. .	.60	cubic feet.
	Sand	. .	.68	"
	Hair	. .	.19	lbs.
	Water	. .	2.68	gallons.
Render and float .	Lime	. .	.46	cubic feet.
	Sand	. .	.70	"
	Hair	. .	.17	lbs.
	Water	. .	2.46	gallons.
Render, float, and set	Lime	. .	.58	cubic feet.
	Sand	. .	.70	"
	Hair	. .	.21	lbs.
	Water	. .	2.70	gallons.
Setting with putty and plaster .	Lime	. .	.12	cubic feet.
	Plaster	. .	.15	stones.
	Water	. .	.65	gallons.

1 Bundle of laths contain (nominally) 500 feet.

Single fir laths are less than a $\frac{1}{4}$ of an inch thick.

Double fir laths are about $\frac{3}{8}$ of an inch thick.

1 Bundle of laths and 500 nails will cover about five superficial yards.

100 yards superficial of LIMEWHITING *once* done requires $1\frac{1}{2}$ cubic feet of lime.

Ditto, ditto, if *twice* done, 2 cubic feet of lime.

12 lbs. of WHITING, $\frac{1}{2}$ lb. blue black, and $1\frac{3}{4}$ gallons of size are required for 100 yards superficial, *once* done; and 21 lbs. of Whiting, $\frac{3}{4}$ lb. blue black, and $2\frac{3}{4}$ gallons of size if *twice* done.

SMITH AND FOUNDER.

THE SIZE OF BOLT HEADS, NUTS AND WASHERS.

Diameter of Bolt=1

Diameter of Head and Nut, square or hexagon=$1\frac{3}{4}$ from side to side.

Diameter of Head and Nut, hexagon = 2 over the angles.

Thickness of Head=$\frac{3}{4}$ of diameter of Bolt.

" Nut=$1\frac{1}{8}$ "

Washers should equal half the thickness of the head, and have twice the area.

Approximately—The weight of a hexagon HEAD and square NUT together will equal a rod of iron in length, five times the diameter of the bolt.

For Square Heads and Nuts, six times the diameter.

And for Rose Heads and Square Nuts, four times the diameter.

RIVETS.

The diameter of a rivet for plates less than $\frac{1}{2}$ in. thick	= *Twice* the thickness of the plate.
Ditto for plates $\frac{1}{2}$ inch thick and upwards	= *Once and a half*, ditto.
Length of rivet measured before clenching	= The thickness of the plates *plus* $2\frac{1}{2}$ times the diameter of the rivet.

The resistance of rivets to shearing equals the cohesive strength due to their cross section.

Engineers assume in practice, that wrought iron may be safely submitted to a tensile strain of 5 tons per square inch, and a compressive strain of 4 tons. Cast iron may be taken at 6 tons in compression, and 1 ton in extension.

CORRUGATED IRON is usually made in sheets from 6 to 8 feet long, and from 2 to 3 feet wide.

The sheets when used for roofing should overlap about 6 inches in girth, and be double riveted at the joints.

One third of the net width may be allowed approximately for lappage and corrugations.

From $2\frac{1}{2}$ to $3\frac{1}{2}$ lbs. of rivets will be required for a square.

SHEET ZINC (Belgian) is usually manufactured in sheets 7 feet long by 2 feet 8 inches, or 3 feet wide.

PLUMBER.

THE THICKNESS OF LEAD.

Weight in lbs. per Foot Superficial.	Thickness in inches.	Weight in lbs. per Foot Superficial.	Thickness in inches.
1	0.017	7	0.118
2	0.034	8	0.135
3	0.051	9	0.152
4	0.068	10	0.169
5	0.085	11	0.186
6	0.101	12	0.203

For Roofs, Flats and Gutters use 7 lb. lead.

For Hips and Ridges use 6 lb. lead.

For Flashings use 5 lb. lead.

Gutters should have a fall of at least 1 inch in 10 feet.

Lead in Gutters, &c., should turn up against the wall from 5 to 7 inches, and be covered with a flashing of at least the same width.

No sheet of lead should be laid in a greater length than 10 or 12 feet without a drip, or break, to allow of expansion.

SOLDERS.

For Lead—Tin, 1 part; lead, 2 parts.
For Tin—Pewter, 4 parts; tin 1; bismuth, 1.
For Pewter—Bismuth, 2 parts; lead, 1; tin, 2.
For Brass—Brass, 2 parts; zinc, 1.
For Gold—Gold, 12 parts; silver, 2; copper, 4.
For Silver—Silver, 5 parts; brass, 6; zinc, 2.
Hard Solder—Copper, 2 parts; zinc, 1.
Soft Solder—Tin, 2 parts; lead, 1.

FLUXES FOR SOLDERING.

Tinned Iron—Resin or Chloride of Zinc.
Copper and Brass—Sal ammoniac or Chloride of Zinc.
Zinc—Chloride of Zinc.
Lead—Resin.

COCKS FOR COPPER.

Content of Copper in gallons.	Bore of Cock in inches.	Weight of Cock in lbs.	Content of Copper in gallons.	Bore of Cock in inches.	Weight of Cock in lbs.
30	$1\frac{1}{2}$	7	200	$2\frac{3}{4}$	30
50	$1\frac{3}{4}$	8	260	3	34
80	2	12	340	$3\frac{1}{4}$	44
120	$2\frac{1}{4}$	19	420	$3\frac{1}{2}$	56
150	$2\frac{1}{2}$	26	430	$3\frac{3}{4}$	70

PAINTER AND GLAZIER

One pound of paint will cover about four superficial yards the first coat, and about six yards each additional coat.

About one pound of putty for stopping will be required for every twenty yards.

One gallon of tar and one pound of pitch will cover about twelve yards superficial the first coat, and about seventeen yards each additional coat.

According to the London Oil and Colour Company's Price List,

1 gallon of	Priming Colour .	will cover	50	super. yards.
,,	White Zinc . . .	"	50	,,
,,	White Paint . .	"	44	,,
,,	Lead Colour . .	"	50	,,
,,	Black Paint . .	"	50	,,
,,	Stone Colour . .	"	44	,,
,,	Yellow Paint . .	"	44	,,
,,	Blue Colour . .	"	45	,,
,,	Green Paint . .	"	45	,,
,,	Bright Emerald Green	"	25	,,
,,	Bronze Green . .	"	45	,,

A Crate of Crown Glass contains;

12	tables of the	Best.
15	,,	Seconds
18	,,	Thirds
18	,,	Fourths

Each Table measures from 48 to 54 inches diameter.

P 2

CONSTANTS OF LABOUR.

The value of Builders' work depends upon
The cost of materials,
,, labour,
,, superintendence,
,, plant,
,, capital,
And upon the sum charged by the Builder for profit.

The cost of labour is dependent upon the wages of the workman, which includes the use of certain tools, and the amount of work which he will perform in a given time—termed the CONSTANT OF LABOUR. To the value of the latter we propose to devote the present section.

The time during each day which the workman is assumed to be at work is 10 hours.

Excavators' Work.

	Days of a ground labourer or navvy.
Excavating only—per cubic yard.	
Vegetable earth	.055
Loam (sand and clay mixed)	.070
Clay	.120
Earth mixed with coarse gravel, &c.	.180
Chalk	.200
Rock requiring blasting	.450

It frequently happens in a gang that a few superior workmen are employed at higher wages than the rest, in which case the average must be taken to obtain the cost of the work.

Throwing with a shovel to a height of 5 feet, or filling trucks—per cubic yard.	
Vegetable earth, loam, or sand	.055
Hard earth, clay, &c.	.062
Mud in a wet state	.080

	Days of a ground labourer.
Filling barrows—per cubic yard.	
Vegetable earth, loam, or sand	.050
Clay, stony earth, &c.	.058
Mud in a wet state	.061
Removing 25 yards with wheelbarrows, depositing and returning—per cubic yard.	
Vegetable earth or loam	.030
Clay, stony earth, sand, or mud	.036
Levelling earth, &c., from barrow heaps without throwing—per cubic yard.	
Vegetable earth, sand, loam, &c. . . .	.012
Clay, stony earth, &c.	.019
Levelling and trimming slopes—per superficial yard.	
Vegetable earth, loam, &c.	.020
Clay, stony earth, &c.	.030
Filling at backs of walls, &c.—per cubic yard.	
Vegetable earth, loam, or sand	.048
Clay, stony earth, &c.	.055
Mud (wet)	.058
Ramming earth—per cubic yard.	
Vegetable earth, loam, or sand, in layers 6 inches thick	.040
Ditto, ditto, in layers 12 inches thick .	.025
Clay puddle—per cubic yard.	
Tempering and spreading in layers 9 inches thick	.650
Ditto, ditto, in layers 12 inches thick .	.550
Turf about 4 in. thick—per superficial yard.	
Cutting and stacking, without removal	.045
Re-sodding	.065

The labour of filling turf into barrows and removing may be taken the same as for clay.

Days of a driver, horse and cart.

Removing 220 *yards lineal, depositing the load and returning—per cubic yard.*

Vegetable earth or loam	.040
Clay, sand, stony earth, &c.	.045

Removing each additional 220 *yards and returning—per cubic yard.*

Vegetable earth, &c.	.027
Clay, sand, stony earth, &c.	.030

Note.—The *vertical* transport of earth is equivalent to 15 times the same horizontal distance when barrows are used, and 12 times when horses and carts.

When earth is removed up an inclined plane not exceeding 1 in 10, the extra labour entailed by each foot of rise is equivalent to removing the same load 10 feet on a horizontal plane.

Bricklayers' Work.

Days of a bricklayer's labourer.

Mixing concrete, wheeling and throwing from a stage	*per cub. yd.*	.300
Mixing mortar with a shovel .	,,	.720

Note.—A two-horse pug mill mixes about 25 yards of mortar *per day*.

Picking up and stacking bricks without moving	*per thousand*	.150
Ditto, ditto, if handed to him .	,,	.100
Selecting bricks for facings . .	,,	.300
Taking down old brickwork laid in mortar, cleaning and stacking the bricks,	*per rod*	4.500

Days of a bricklayer and labourer.

Brickwork in mortar to walls exclusive of face work	*per rod*	3.500
Ditto, in cement, ditto, ditto . .	,,	4.100
Ditto . . . covering arches, &c. . .		4.500

		Days of a bricklayer and labourer.
Ditto, to ovens and coppers . .	*per cub. yd.*	.480
Rough axed arches over openings,	*per sup. ft.*	.030
Add, if elliptical	,,	.020
Add, if pointed with mortar . .	,,	.015
Gauged arches, rubbed only . .	,,	.120
Ditto, ditto, cut and set in putty	,,	.200
Add, if elliptical	,,	.030
Pointing, flat joint in mortar .	*per sup. yd.*	.125
Ditto, in cement	,,	.133
Add, for raking out mortar joints	,,	.124
Add, for raking out cement joints	,,	.175
Add, if worked from a scaffold, including erecting and removing	,,	.025
Pointing, tuck, in mortar, exclusive of raking out the joints .	,,	.250
Ditto, ditto, in cement ,, .	,,	.258
Bricknogging set flat in mortar .	,,	.080
Ditto, on edge in mortar . . .	,,	.060
Paving with stock bricks laid flat in sand	,,	.043
Ditto, ditto, on edge in sand . .	,,	.065
Ditto, ditto, laid flat in mortar .	,,	.070
Ditto, ditto, on edge in mortar .	,,	.086
Ditto, ditto, laid flat in cement .	,,	.080
Ditto, ditto, on edge in cement .	,,	.100
Ditto, with paving bricks laid flat in sand	,,	.040
Ditto, ditto, on edge in sand .	,,	.104
Ditto, ditto, laid flat in mortar .	,,	.080
Ditto, ditto, on edge in mortar .	,,	.120
Tiling, plain, 3 inch gauge . .	*per* 100 *feet*	.740
Ditto, ditto, $3\frac{1}{2}$ ditto	,,	.720
Ditto, ditto, 4 ditto	,,	.700
Ditto, pan, laid dry	,,	.400
Add to pantiling, if pointed outside	,,	.240

		Days of a bricklayer and labourer.
3 inch drain pipes, laying and jointing in cement . . .	*per lineal foot*	.008
4 inch ditto, ditto	„	.011
6 inch ditto, ditto	„	.016
9 inch ditto, ditto	„	.023
12 inch ditto, ditto	„	.031
15 inch ditto, ditto	„	.040
18 inch ditto, ditto	„	.050
Sash and door frames, bedded and pointed	*each*	.075
Chimney pots, 1st size, set in mortar	„	.098
Ditto, 2nd size, set in mortar .	„	.080
Ditto, 3rd size „ .	„	.065
Add to chimney pots if set in cement	„	.020

		Days of a bricklayer only.
Working each fair face to brickwork in mortar, including pointing the joints	*per sup. ft.*	.007
Ditto, ditto, in cement	„	.009
Add for malm or other facings of superior bricks	„	.006
Add for circular face worked to template	„	.005
Rough cutting to brickwork . .	„	.015
Fair ditto	„	.040
Cutting to groin points (the first ring)	*per lineal foot*	.100

Add to pantiling, if pointed inside	*per* 100 *feet*	.150

Masons' Work.

	Days of a labourer.
Rubble stone—per cubic yard.	
Filling barrows	.060
Removing 25 yards and returning with the empty barrow	.040
Unloading barrows	.030
Taking down old masonry built with mortar, cleaning and stacking the stone	.600

	Days of a mason and labourer.
Rubble masonry—per cubic yard.	
Built dry in courses to foundations, &c.	.240
Ditto, with mortar to ditto	.280
Ditto, ditto, above ditto	.310
Ditto, ditto, when all the beds are horizontal	.480
Add, if built with cement	.090
Ashlar Masonry—per cubic foot.	
Rough facing averaging 12 inches thick to rubble work, with chisel drafted margins built in courses 12 inches high	.080

		Days of a mason only
Add to rubble masonry for each fair face	*per sup. ft.*	.010
Add to last, if hammer dressed	„	.030
Ditto, ditto, if curved	„	.046

Purbeck Stone.

Plain work, tooled	*per superficial foot*	.150
Ditto, circular	„	.175
Sunk work, tooled	„	.170
Ditto, circular	„	.200

TABLE SHOWING THE LABOUR ON PORTLAND STONE, &c.

Description of Labour	Time of a Mason or Stonecutter, per sup.ft.		
	Caén.	Bath.	Portland.
	Days.	Days.	Days.
Sawing (whole)	.030	.025	.060
Plain work, chiselled	.060	.055	.085
Ditto, rubbed	.072	.066	.100
Ditto, ,, circular	.090	.080	.140
Ditto, tooled	.078	.072	.130
Ditto, ,, circular	.100	.094	.155
Sunk work, rough	.075	.068	.120
Ditto, ,, circular	.095	.090	.145
Ditto, rubbed	.090	.082	.148
Ditto, ,, circular	.110	.103	.173
Ditto, tooled	.092	.085	.150
Ditto, ,, circular	.115	.105	.175
Moulded work, rubbed	.155	.150	.200
Ditto, ,, circular	.200	.190	.300
Ditto, Gothic ,,	.240	.230	.400
Dttto, ,, ,, circular	.318	.300	.530
Spherical work, plain	.255	.240	.420
Ditto, rubbed	.285	.265	.470

YORKSHIRE STONE.

		Days of a mason.
Whole sawing	*per superficial foot*	.080
Rough face	,,	.080
Ditto, sunk work	,,	.140
Add for each tooled face	,,	.070
Ditto rubbed face	,,	.080
Ditto circular face	,,	.055
Moulded work, plain tooled	,,	.300
Add if circular	,,	.100
Ditto if rubbed	,,	.085

Table Showing the Labour on Granite.

Description of Labour.	Time of a Mason, per Superficial ft.	
	Cornish.	Aberdeen.
	Days.	Days.
Plain face, roughly axed	.125	.146
Ditto, ditto, circular	.155	.175
Ditto, fine axed	.175	.200
Ditto, ditto, circular	.215	.240
Sunk work, roughly axed	.190	.215
Ditto, ditto, circular	.240	.265
Ditto, fine axed	.235	.270
Ditto. ditto circular ...	.290	.325
Moulded work	.380	.425
Ditto, circular	.500	.545

Table Showing the Labour on Marble.

Description of Labour, including Sawing and Polishing.	The time of a Mason per superficial foot.	
	Statuary, or Veined.	Kilkenny, or Black.
	Days.	Days.
Plain work..........................	.660	.800
Ditto circular..............	.860	1.000
Sunk work..........................	1.220	1.505
Ditto circular..............	1.800	2.080
Moulded work	1.800	2.080
Ditto circular........	2.610	2.880

	Days of a mason and labourer.
Taking up 2 and 2½ inch paving and piling near the site . . . *per superficial foot*	.006
Ditto 3 and 4 inch, and ditto ”	.008

		Days of a pavior and labourer.
Granite or other pitcher paving in courses averaging 6 inches laid in gravel—per sup. yd.		
6 inches deep	”	.076
7 ”	”	.080
8 ”	”	.084
9 ”	”	.087
Add if grouted with thin mortar	”	.016
Add if grouted and set with mortar	”	.035
Pebble paving laid in gravel	”	.050

		Days of a mason and labourer.
Cube stone, hoisted and set in mortar	—*per cub. ft.*	.028
Ditto, ditto cement	”	.035
Add when in scantling lengths or large sizes	”	.010
Yorkshire or other paving, setting only in mortar—		
2 inch	*per superficial foot*	.013
$2\frac{1}{2}$ ”	”	.014
3 ”	”	.018
4 ”	”	.022

The labour of squaring flags for paving varies from .008 to .012 days of a mason per foot superficial for 2 and $2\frac{1}{2}$ inch, and from .012 to .015 days for 3 and 4 inch, according to the size of each flag.

		Days of a labourer.
Breaking stones to a size that will pass through a ring $1\frac{1}{2}$ inches in diameter .	*per cubic yard*	1.700

This constant has been obtained from experiments on limestone and stones somewhat harder than Purbeck; but for granite and very hard siliceous stones it should be increased by about one-third.

		Days of a labourer.
Spreading broken stones as for metalling roads, in thickness of 3 inches	—*per superficial yard*	.022

		Days of a slate mason.
Planing slate slabs	*per sup. ft.*	.016
Polishing, ditto, with sand . .	,,	.025
Ditto, with very fine sand, or rubbing	,,	.030
Filing square to edges of slate slabs—per lineal foot.		
½ inch thick	,,	.013
¾ inch ditto	,,	.016
1 inch ditto	,,	.021
1¼ inch ditto	,,	.024
1½ inch ditto	,,	.028
2 inch ditto	,,	.040
Rounded nosings to slate slabs—per lineal foot.		
½ inch thick	,,	.024
¾ inch ditto	,,	.030
1 inch ditto	,,	.036
1¼ inch ditto	,,	.041
1½ inch ditto	,,	.046
2 inch ditto	,,	.050
Grooving for zinc or iron tongued joints, each groove . . .	*per lineal foot.*	.016
Ditto, for slate tongue	,,	.026

Slaters' Work.

Description of Slate.	The time of a Slater and labourer per square.	
	Laying only.	Preparing and laying.
	Days.	Days.
Doubles	.170	1.000
Ladies	.150	.900
Countesses	.140	.600
Duchesses	.125	.500
Queens (average size)...	.130	.800

		Days of a slater and labourer.
Plastering against underside of slating,	*per superficial yard*	.050

CARPENTERS' WORK.

Sawing Timber—per superficial foot.

	Days of a pair of sawyers.
Fir	.0025
Pine	.0022
Oak, English	.0045
Ditto, Baltic or American	.0038
Ditto, African	.0038
Ash, beech, or birch	.0034
Elm	.0033
Teak	.0050
Mahogany, Honduras	.0033

Add two-thirds to any of the above if sawn arriswise.

	Days of a carpenter
To work one cubic foot of fir into plates, bond timbers, ground joists, &c., when	
16 square inches in section and under	.060
36 ditto "	.053
81 ditto "	.046
Over "	.040
Ditto, ditto, into rafters, purlins, ceilings, joists, &c., when	
16 square inches in section and under	.080
36 ditto "	.069
81 ditto "	.061
Over ditto "	.054
Ditto, ditto, into rough frames, as in naked floors, &c., when the section is not less than 16 *square inches*	.100
Ditto, ditto, into trusses, &c., when the section is not less than 16 *square inches*	.135

Labour on Fir Timber.

Description and Scantling.	The time of a Carpenter—per cubic foot.				
	Rough.	Wrought 1 side.	Wrought 2 sides.	Wrought 3 sides.	Wrought all round.
Framed and fixed	Days.	Days.	Days.	Days.	Days.
Under 16 square inches in section...	.160	.208	.232	.256	.280
„ 36 ditto ...	.138	.174	.192	.210	.228
„ 81 ditto ...	.122	.150	.164	.178	.192
Over 81 ditto ...	.108	.128	.138	.148	.158
Add, if diminished	.060	.065	.070	.075	.080

Curved work usually takes one-half more labour than straight.

The labour on oak may be taken at $1\frac{1}{3}$ of the above for large, and $1\frac{1}{2}$ times for very small timbers.

		Days of a carpenter.
Planing fir	*per sup. ft.*	.013
Ditto, including squaring .	„	.017
Sawing off the heads of fir piles with a handsaw . .	„	.050
Ditto ditto oak ditto .	„	.090
Ditto the ends of sheeting piles or planking ditto .	„	.110
Holes averaging $\frac{3}{4}$ inch diameter bored through fir for bolts, &c.	—*per lineal ft.*	.020
Ditto ditto through oak	„	.030
Forming a single tennon including the mortice to fir posts—		
Under 16 square inches in section	—*each*	.040
36 ditto	„	.060
81 ditto	„	.080
144 ditto	„	.100
Forming a double tennon including the mortice to fir posts—		
Under 16 square inches in section	—*each*	.060
36 ditto	„	.090
81 ditto	„	.120
144 ditto	„	.150

CENTERING.

Description.	Time of a Carpenter.	Time of a Labourer.
	Days.	Days.
For plain cylindrical vaults or arches ....*per square*	1.550	.750
„ groined arches ...... „	3.200	1.000
„ skew ditto ...... „	1.700	.800
„ drains, sewers, &c.—*per sup. ft.*	.022	—
„ coach head trimmer arches .... „	.055	—

		Days of a carpenter.
Turning piece to $4\frac{1}{2}$ inch soffit	—*per lineal foot*	.018
Extra to groin points . . .	„	.100

DEALS FIXED COMPLETE—*per superficial foot.*

Thickness.	The time of a Carpenter.					
	Rough.	Edges shot.	Wrought one side and edges.	Wrought both sides and edges.	Wrought one side & framed.	Wrought both sides & framed.
In widths of 6 in and upwards in unframed work, or over 4 super. feet in framed work—	Days.	Days.	Days.	Days.	Days.	Days.
½ inch	.0066	.0110	.0170	.0230	.0366	.0461
¾ "	.0075	.0127	.0187	.0247	.0399	.0496
1 "	.0084	.0144	.0204	.0264	.0432	.0532
1¼ "	.0095	.0165	.0228	.0291	.0471	.0576
1½ "	.0105	.0185	.0251	.0317	.0511	.0622
2 "	.0126	.0226	.0298	.0370	.0589	.0711
2½ "	.0147	.0267	.0345	.0423	.0668	.0801
3 "	.0168	.0308	.0392	.0476	.0746	.0890
In widths of less than 6 in. in unframed work, or under 4 super. feet in framed work—						
½ inch	.0088	.0146	.0226	.0286	.0436	.0531
¾ "	.0100	.0169	.0249	.0309	.0474	.0571
1 "	.0112	.0192	.0272	.0332	.0512	.0612
1¼ "	.0124	.0217	.0301	.0364	.0556	.0661
1½ "	.0136	.0243	.0331	.0397	.0601	.0712
2 "	.0160	.0293	.0389	.0461	.0689	.0811
2½ "	.0184	.0344	.0448	.0526	—	—
3 "	.0208	.0394	.0506	.0590	—	—

FLOORS OF DEAL PREPARED AND LAID COMPLETE, WITH BROKEN JOINTS—*per square.*

Thickness.	The time of a Carpenter.					
	In Deal Widths.			In Batten Widths.		
	Rough edges Shot and Fillistered.	Wrought edges Shot and Fillistered.	Wrought rebated and Filleted.	Rough edges Shot and Fillistered.	Wrought edges Shot and Fillistered.	Wrought rebated and Filleted.
	Days.	Days.	Days.	Days.	Days.	Days.
$\frac{3}{4}$ inch	.720	1.120	..	.820	1.220	..
1 "	.810	1.215	..	.940	1.335	..
$1\frac{1}{4}$ "	.945	1.370	1.950	1.085	1.505	2.270
$1\frac{1}{2}$ "	1.075	1.515	2.155	1.245	1.680	2.560
2 "	1.365	1.805	2.550	1.558	2.040	3.000
$2\frac{1}{2}$ "	1.585	2.085	2.900	1.875	2.390	3.418
3 "	1.850	2.350	3.250	2.180	2.735	3.805

Floors of Deal prepared and laid complete, with Straight Joints and Tongued Headings —*per square.*

Thickness.	The time of a Carpenter.			
	In Deal Widths.		In Batten Widths.	
	Wrought.	Wrought, Rebated, and Filleted.	Wrought.	Wrought, Rebated, and Filleted.
	Days.	Days.	Days.	Days.
1 inch ..	1.435	2.185	1.595	—
1¼ " ..	1.605	2.455	1.795	2.565
1½ " ..	1.795	2.450	2.010	2.825
2 " ..	2.160	2.880	2.420	3.380
2½ " ..	2.520	3.290	2.840	3.870
3 " ..	2.880	3.680	3.260	4.330

Floors of English Oak prepared and laid complete, in 7 inch widths—*per square.*

Thickness.	The time of a Carpenter.				
	Broken Joints.		Straight Joints.		
	Rough Edges Shot and Fillistered	Wrought Edges Shot and Fillistered	Wrought Edges Shot and Fillistered	Wrought, Rebated, and Filleted, or Ploughed and Tongued.	Add if Oak Tre-nails are used instead of Nails.
	Days.	Days.	Days.	Days.	Days.
1 inch ..	1.640	2.440	2.640	—	—
1¼ " ..	1.900	2.740	2.940	4.000	.700
1½ " ..	2.180	3.060	3.260	4.500	.800
2 " ..	2.740	3.700	3.900	5.000	1.000
2½ " ..	3.280	4.320	4.500	5.750	1.200

DOORS AND GATES OF DEAL, LEDGED—*per superficial foot.*

Thickness.	The time of a Carpenter.							
	Rough and edges shot	Add if braced.	Wrought.	Wrought, ploughed, and tongued, or rebated.	Add if braced.	Add if hung.		
						In one leaf.	In two leaves.	In two heights.
	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.
¾ inch ..	.017	.004	.033	.038	.008	.010	.013	.015
1 ,, ..	.019	.005	.035	.042	.008	.012	.016	.018
1¼ ,, ..	.022	.005	.039	.047	.009	.014	.018	.021
1½ ,, ..	.025	.006	.042	.051	.010	.016	.021	.024
2 ,, ..	.030	.006	.049	.059	.010	.020	.026	.030

Doors and Gates of Deal, Framed and Braced—*per superficial foot.* (*Including hanging.*)

Thickness.	The time of a Carpenter.		
	Wrought, rebated and beaded.	Add if herring-boned, solid at the back.	Add if hung folding.
	Days.	Days.	Days.
1½ inch ..	.080	.016	.013
2 " ..	.094	.019	.016
2½ " ..	.107	.021	.018
3 " ..	.120	.024	.021

If framed with a wicket add to the superficial contents of the gate measured over all, the net surface of the wicket, to pay for the labour of forming and hanging.

Doors of Deal Framed in Panels—*per super. foot.* (*Including hanging.*)

Thickness.	The time of a Carpenter.				
	Square and flat.	Flush one side or bead butt.	Flush both sides or bead butt.	Add to each face if bead flush.	Add to each face if moulded.
	Days.	Days.	Days.	Days.	Days.
2 *Panels.*					
1¼ inch ..	.063	.071	..	..	.010
1½ " ..	.069	.077	.085	.007	.011
2 " ..	.080	.090	.099	.008	.013
2½ " ..	.092	.103	.114	.009	.014

Doors of Deal Framed in Panels.—*continued.*

Thickness.	The time of a Carpenter.				
	Square and Flat.	Flush O. S.	Flush B. S.	Add to each face if bead flush.	Add to each face if moulded.
	Days.	Days.	Days.	Days.	Days.
4 Panels					
$1\frac{1}{4}$ inch ..	.070	.079	..	..	.011
$1\frac{1}{2}$ " ..	.077	.086	.095	.008	.011
2 " ..	.089	.100	.111	.009	.014
$2\frac{1}{2}$ " ..	.102	.114	.126	.010	.016
3 " ..	.114	.128	.142	.011	.018
6 Panels..					
$1\frac{1}{4}$ inch ..	.079	.088	..	..	.013
$1\frac{1}{2}$ " ..	.085	.096	.106	.009	.013
2 " ..	.099	.111	.123	.010	.016
$2\frac{1}{2}$ " ..	.113	.127	.140	.011	.018
3 " ..	.127	.142	.158	.012	.020

Add to Doors Framed in Panels :—

If double margins each $4\frac{1}{2}$ inches wide, *per super. foot.* .018

Ditto, ditto, if 6 inches wide " .035

If hung folding . . . . . . " .012

The labour to curved heads of doors is usually assumed to be double that of square heads.

Door Linings.—Jambs and soffits wrought—back rebated and grooved together at the head—fixed complete, including plugs, backings, &c.—*per superficial foot.*

Thickness.	The time of a Carpenter.						
	Plain.	Single rebated.	Double rebated.	Framed square and flat, and 1 or 2 panels in height. Single rebated.	Framed square and flat, and 3 or 4 panels in height. Single rebated.	Add if moulded. 1 and 2 panels.	Add if moulded. 3 and 4 panels.
	Days.	Days.	Days.	Days.	Days.	Days.	Days.
$\frac{3}{4}$ inch ..	.018	—	—	—	—	—	—
1 ,, ..	.020	.028	.036	.064	.072	—	—
$1\frac{1}{4}$,, ..	.023	.030	.038	.070	.079	.011	.013
$1\frac{1}{2}$,, ..	.025	.033	.041	.076	.086	.011	.013
2 ,, ..	.030	.039	.048	.089	.099	.014	.016
$2\frac{1}{2}$,, ...	.036	.046	.055	.102	.113	.016	.018

			Days of a Carpenter.
Mouldings, including double Architraves—*per superficial foot*			.100
Framed Grounds, 1 inch thick		,,	.060
Ditto	$1\frac{1}{4}$,, ...	,,	.065
Ditto	$1\frac{1}{2}$,, ...	,,	.074

STAIRCASES—*per superficial foot,*
(including Carriages and Brackets).

Thickness.	The time of a Carpenter.				
	Rough, with edges shot.	Wrought with rounded nosings.	Wrought, glued, and blocked, with rounded nosings.	Wrought, glued, and blocked, with rounded nosings and moulded.	Add, if risers be tongued into the treads on one edge.
	Days.	Days.	Days.	Days.	Days.
1 inch ..	.029	.054	.061	.070	.006
$1\frac{1}{4}$ " ..	.033	.060	.068	.078	.007
$1\frac{1}{2}$ " ..	.037	.066	.075	.085	.008
2 " ..	.045	.078	.088	.098	.009

		Days of Carpenter.
Add to staircases, if mitred to cut-string on one end and dovetailed for balusters	*per super. foot.*	
For 1 inch thick	"	.200
$1\frac{1}{4}$ "	"	.220
$1\frac{1}{2}$ "	"	.240
2 "	"	.280
RETURN NOSING to ends of steps, including mitres	*each.*	.030
Ditto, ditto, circular on plan .	"	.060
Ditto, moulded ditto	"	.055
SCROLL BRACKETS mitred to risers	"	.100
Ditto, circular on plan	"	.180
HOUSING and wedging ends of steps into string	*per foot run.*	.025
Ditto, in steps with moulded nosings	"	.030
Ditto, ditto, with circular ends .	"	.080
SOLID QUARTER ROUNDS to ends of steps	—*each*	.250
Ditto, veneered	"	.500

		Days of a Carpenter.
Proper Curtail-end to steps, with riser complete, veneered	*each*	1.500
Outside Strings.		
$1\frac{1}{4}$ inch plain, wrought—	*per superficial foot.*	.040
$1\frac{1}{2}$ ”	”	.045
2 ”	”	.050
Add if **Sunk.**		
To $1\frac{1}{4}$ inch	”	.025
$1\frac{1}{2}$ ”	”	.027
2 ”	”	.030
Add if **Moulded.**		
To $1\frac{1}{4}$ inch	”	.013
$1\frac{1}{2}$ ”	”	.014
2 ”	”	.015
Add if cut for **Steps and Risers.**		
$1\frac{1}{4}$ inch	”	.021
$1\frac{1}{2}$ ”	”	.022
2 ”	”	.024
Add if cut for **Steps and Risers, and Mitred.**		
$1\frac{1}{4}$ inch	”	.060
$1\frac{1}{2}$ ”	”	.063
2 ”	”	.066

Wreathed or circular strings are to be taken at 4 times the rate of straight.

Wall Strings, plain and plugged—*per sup. ft.*		
$1\frac{1}{4}$ inch	”	.050
$1\frac{1}{2}$ ”	”	.055
2 ”	”	.062
If **Moulded** add	”	.018
Handrails, $2\frac{1}{2}$ by $2\frac{1}{2}$ inches .	*per lineal foot*	.040
Ditto, ditto, moulded .	”	.060
Ditto, 3 by 3 inches .	”	.050
Ditto, ditto, moulded	”	.075

		Days of a carpenter
RAMP AND KNEES TO HANDRAILS,		
$2\frac{1}{2}$ by $2\frac{1}{2}$ inches, moulded .	*per lineal foot.*	.333
Ditto, 3 by 3 in. ,, .	,,	.420
HANDRAILS WREATHED OR TWISTED,		
$2\frac{1}{2}$ by $2\frac{1}{2}$ inches	,,	.800
Ditto, 3 by 3 inches . . .	,,	1.000
For the labour on mahogany handrails take $1\frac{1}{2}$ times that for deal.		
SINKING HANDRAILS FOR BALUSTERS.		
If Straight	,,	.012
Ramped or circular . .	,,	.050
Wreathed	,,	.100
NEWELS, wrought and framed,		
$2\frac{1}{2}$ by $2\frac{1}{2}$ inches	,,	.048
Ditto, ditto, 3 by 3 inches .	,,	.056
BAR BALUSTERS, &c., 1 by 1 inch	,,	.017
Ditto, $1\frac{1}{4}$ by $1\frac{1}{4}$,,	,,	.019
Ditto, $1\frac{1}{2}$ by $1\frac{1}{2}$,,	,,	.021
BALUSTERS, dovetailed	*each.*	.008
JOINTS IN CONTINUED HANDRAIL . .	,,	.150
DOVETAILS in steps for balusters . .	,,	.167
IRON BALUSTERS, fixing	,,	.070
Ditto NEWELS ,, ...	,,	.300
MITRES TO CAPS	,,	.170
Housings in handrails for balusters,		
straight	,,	.016
Ditto, ditto, raking	,,	.024
SASHES, fixed complete . .	*per super. foot.*	
$1\frac{1}{2}$ inch deal moulded or bevel bar	,,	.045
Ditto mahogany or wainscot . .	,,	.058
2 and $2\frac{1}{2}$ inch deal	,,	.060
Ditto mahogany or wainscot . .	,,	.085

Curved heads when measured square may be taken at double the labour of straight.

		Days of a carpenter.
FRAMES, deal cased with oak, sunk sills, deal pulley styles, &c., complete, prepared for 1½ inch sashes single hung . . .	*per super. foot*	.045
Ditto, when prepared for 2 or 2½ inch sashes	„	.056
Add to frames for 1½ inch sashes if with wainscot or mahogany pulley pieces, beads, &c. . .	„	.008
Add to 2 or 2½ inch ditto . . .	„	.015
Add to frames if the sashes are double hung	„	.012
Take curved heads at double the labour of straight as described for the sashes.		
FRENCH CASEMENTS, fitted and hung complete.		
1½ inch deal ovolo, or bevelled bar	„	.050
2 „ „	„	.060
2½ „ „	„	.064
Add if wainscot or mahogany.		
1½ inch	„	.020
2 and 2½ inch	„	.025
Add to deal casements if with margin lights	„	.016
Add to wainscot or mahogany if ditto	„	.028
Add to deal if in two heights . .	„	.018
Add to wainscot or mahogany if ditto	„	.032
If circular or plan flat sweep take 1½ times the straight, and if quick sweep take double.		
SKYLIGHTS, fixed complete.		
1½ inch deal ovolo, &c.	„	.040
2 „ „	„	.048
Add to 1½ inch skylights if oak instead of deal	„	.015
Ditto to 2 inch ditto	„	.020

		Days of a carpenter.
Window Linings.		
1 inch deal, 2 panel square, framed back lining . .	*per super. foot.*	.095
Add if bead butt or moulded . .	"	.012
Add if bead flush or quirk moulded,	"	.018
Add for each panel above 2, if square framed	"	.018
Ditto ditto, if moulded,	"	.024
Add if splayed	"	.007
Window Backs, Elbows, and Soffits. 1 inch deal, plain keyed, or 2 panel, square backs	"	.070
Ditto, ditto, elbows and soffits .	"	.075
Add if splayed	"	.008
Add if bead butt or moulded . .	"	.010
Boxings to Windows.		
Wrought, rebated, framed, and beaded boxings	"	.090
Ditto, ditto, splayed . . .	"	.109
Outside Shutters.—Take the labour for 2 panels and 4 panels the same as for 4 and 6 panel doors respectively.		
Inside Shutters.		
¾ inch deal clamped flaps, in one height	"	.095
1 inch deal, 2 panel ditto, square framed, in one height . . .	"	.100
Add to square framed for every panel above two	"	.020
Add if bead butt or moulded on one side	"	.018
Add if bead flush or quirk moulded	"	.022
Add if hung in two heights . . .	"	.012
Skirtings, including backings, &c., fixed complete.		
¾ inch, square	"	.035
1 "	"	.040

		Days of a carpenter
Add if beaded or chamfered .	*per super. foot.*	.008
Add if torus moulded	,,	.015
Add if otherwise moulded . . .	,,	.030
Add if scribed to steps and risers of staircase.		
$\frac{3}{4}$ inch	,,	.030
1 ,, ...	,,	.034
$1\frac{1}{4}$,, ...	,,	.038
SUNDRIES.		
GROOVING and tongueing .	*per lineal foot.*	.008
Ditto ditto, cross grain . .	,,	.015
MOULDINGS under 3 inches girth .	,,	.025
SASH-BEADS prepared and fixed complete	,,	.020
BEADING, $\frac{1}{2}$ inch diameter and under	,,	.003
Ditto, $\frac{5}{8}$ to $1\frac{1}{2}$ inch	,,	.006
ROUNDED EDGES on 1 inch deal and under	,,	.005
Ditto $1\frac{1}{8}$ to 2 inches ditto	,,	.007
Ditto $2\frac{1}{8}$ to 3 ,, ...	,,	.009
CHAMFERING, 1 inch wide and under	,,	.003
Ditto, 2 inches	,,	.006
Ditto, 3 ,, ...	,,	.008
EDGES SHOT.		
1 inch and under	,,	.002
2 ,, ,, ...	,,	.003
3 ,, ,, ...	,,	.004
HEADINGS CUT AND FORMED TO PALISADES, &c.	*each.*	.025
Ditto ditto, posts	,,	.050

PLASTERERS' WORK.

		Days of a labourer.
Lime and Hair, mixing . .	*per cubic foot.*	.032
Fine Stuff or putty, ditto . .	,,	.040
		Days of a plasterer, labourer, and boy.
Rendering or Pricking up—	*per sup. yard.*	.018
Ditto ditto curved . .	,,	.023
Rendering and Setting with fine stuff	,,	.030
Ditto ditto curved . .	,,	.037
Rendering 2 Coats and Setting,	,,	.042
Rendering and Floating . .	,,	.038
Ditto ditto, curved .	,,	.052
Setting only with fine stuff . .	,,	.012
Ditto with putty and plaster,	,,	.020
		Days of a plasterer and boy.
Lathing only with single fir laths,	,,	.018
Ditto ditto, curved . .	,,	.025
Add if with double fir laths . .	,,	.003
		Days of a plasterer, labourer, and boy.
Stucco	,,	.070
Ditto, curved	,,	.085
Ditto, trowelled	,,	.082
Ditto, ,, curved	,,	.090
		Days of a plasterer and labourer.
Rendering with Cement and Sand	,,	.083
Ditto ditto, curved,	,,	.110
Rendering and Floating with ditto	,,	.125
Ditto ditto, curved	,,	.165
Add if jointed in imitation of stone	,,	.025

		Days of a plasterer and labourer.
ROUGH CASTING with lime and fine gravel	,,	.015
Ditto ditto, curved	,,	.036
CORNICES AND MOULDINGS IN PLASTER, including every preparation for the same .	*per super. foot.*	.040
LIMEWHITING	*per super yard.*	.004
WHITING AND SIZE (exclusive of scouring)	,,	.005
Ditto, 2 coats (ditto)	,,	.009
COLOURING STONE OR BUFF, &c. (exclusive of scouring) . . .	,,	.007
Ditto, 2 coats (ditto)	,,	.012
QUIRKS run in plaster . .	*per lineal yard.*	.020
Ditto ,, curved . .	,,	.030
Ditto run in cement	,,	.030
Ditto ,, curved . .	,,	.045
BEAD AND QUIRK in plaster . .	,,	.030
Ditto ,, curved . .	,,	.055

PAINTERS' AND GLAZIERS' WORK.

		Days of a painter.
PAINTING COMMON COLOURS IN OIL—	*per sup. yd.*	
1st coat, including knotting, stopping, &c.	,,	.025
2nd and following coats, each . . .	,,	.012
IRON BAR, &c., 1 coat . .	*per lineal yard.*	.006
SASH SQUARES, each side—	*per dozen squares.*	.070
Ditto, 2 coats . .	,,	.100
TARRING WITH STOCKHOLM TAR—	*per sup. yd.*	.040
Ditto, 2nd and following coats . .	,,	.027

		Days of a glazier.
GLAZING	*per superficial foot.*	
Crown glass stopped into new sashes	,,	.019
Ditto ,, old sashes	,,	.060

THE VALUATION OF PROPERTY.

For the valuation of property it will be necessary to ascertain:—

1. The annual value.
2. The capital value.

The annual value is to be obtained in most cases from the rent or income received by the proprietor, or by a careful inspection of the property in question, and an inquiry into the nature and extent of the burdens upon it.

The capital value is to be obtained from the *net* annual value by means of the proper tables, as will be shown in another part of this section.

The Valuation of Land.

The value of land depends upon its agricultural produce, modified by the cost of cultivation and sale, including the interest upon capital, depreciation of stock and implements, a salary to the farmer for loss of time and labour in superintendence, and also upon the taxes or other burdens which fall upon the tenant. These considerations usually determine the rent to be received by the owner.

The rent of land, however, is not to be taken as complete evidence of its value, as there may be circumstances peculiar to the tenancy, which have caused either a considerable reduction or an increase of rent.

When the land is leased the value will have to be taken during the term of the lease as equal to the rent reserved, capitalized; and this should be added to the present value of the reversion to the improved rent.

But where no lease exists, or the land is let apparently for more than its value, an independent estimate will have to be made as to what may be considered a fair rent for a yearly tenant to pay.

To enable the valuer to arrive at this conclusion with any degree of certainty he will require to become acquainted with:—

1. The acreable contents and situation of each field, as shown by a good map.

2. The nature of the soil, and if suitable for the description of produce likely to obtain a ready sale in the market; taking care not to be misled by a high or low state of cultivation, for which it is unfair to charge the tenant in one case or the landlord in the other.

3. The depth of the surface soil, which is usually termed *deep* if more than 10 inches, and *shallow* if less than 8 inches.

4. The nature of the subsoil, and if retentive or porous; a retentive subsoil to a stiff clay surface, for example, renders the latter almost unfit for tillage; but with a porous subsoil the land may be improved by the addition of sand, lime, vegetable matter, or other ingredients of which the soil is deficient.

5. The aspect, contour, and elevation—a bad aspect causes the harvest to be late and consequently the produce to be late in the market, besides more or less affecting the quality of the crop.

Steepness or declivity causes the expense of cultivation and gathering to be increased, owing to the men and horses having to work up and down hill, besides the up land is likely to be deprived of its share of moisture, while the low land is injured by an over quantity.

An irregular contour affects the value from the variableness in the growth of the crops and the quantity of seed required in one place more than in another.

Elevated situations are usually exposed to the prevailing winds which may prove injurious.

6. The supply of water, which should be of good quality, abundant, and convenient for the use of the live stock.

7. The kind of manure of which the soil is most in need, and if it can be obtained on the farm.

8. The distance to the nearest town or market, and the facility of obtaining manure at a moderate expense when it is not to be procured on the land.

Small villages seldom affect the value of the land in their neighbourhood, but large villages and market towns containing from 1000 to 5000 inhabitants may be assumed to increase the value slightly to a distance of about three miles; that next the town being of greater value than that more remote.

Market towns containing from 5000 to 50,000 inhabitants affect the value of the land used for agricultural purposes in their vicinity to a distance of about four miles; the value of that next the town being probably worth 50 per cent. more than that at four miles distant.

Cities or large towns containing over 50,000 inhabitants increase the value of land used for agricultural purposes in their immediate vicinity probably to the extent of 100 per cent., and at a distance of from one to two miles about 60 per cent., beyond two miles and up to five miles the increase will vary from 25 to 50 per cent.

When the distance exceeds five miles the proximity to a railway station or canal is frequently more advantageous; at a lesser distance the facility of obtaining manure and carting direct to the site, combined with a ready market, present greater advantages than the facility afforded by a railway or canal alone.

Very large cities or towns affect the value of land in their vicinity to a much greater distance than small ones, but in a more irregular manner, owing to the preference given to some localities in the neighbourhood above others for building purposes; such cases require special consideration.

9. The quality and contour of the roads.

If the roads are bad and hilly the expense of communication with the market frequently renders inferior

land, or land at a greater distance but with better roads, of more value.

The following table shows the allowance to be made for steep roads, assuming that one ton can be carried with the unit of labour at the rate of three miles per hour on the level:—

When the inclination is		Take 1 mile as if it were	
	1 in 80		1¼ miles.
	40		1½ „
	27		1¾ „
	20		2 „
	16.5		2¼ „
	13.5		2½ „
	11.7		2¾ „
	10		3 „

10. The farm should be assumed as possessing every accommodation essential to its proper working. The buildings and fences should be complete, in good order, and suitable to the size and condition of the farm, and the expense of making them so, if insufficient or out of repair, should be taken as so much capital sunk.

The homestead and farm buildings generally should form a separate item in the valuation.

The valuer having arrived at the *gross* annual value, or rent that may reasonably be expected from a tenant, and having considered the value of the minerals, water power as applicable to the working of machinery, the manorial or other rights attached to the land, the capability for improvement, and having made the proper allowance for outgoings, in the shape of repairs, renewals, quit rents, taxes, and other charges upon the landlord's interest, together with the expense of collecting the rents, he will then obtain the *net* annual value.

The Valuation of Buildings.

The rent received for a house which is let to a yearly tenant who pays the usual tenants' rates and taxes may be taken as an indication of its value. It is desirable,

however, as we have stated when treating of the valuation of land, that the valuer should form an independent estimate as to what may be considered a fair rental. In this he may be assisted in most instances by a comparison with other buildings in the neighbourhood, the rent and circumstances of which can be ascertained.

The value of a building primarily depends upon the cost of erection, the capacity, fitness, age, state of repair, and locality.

In the absence of authentic information, the cost of erection may be found approximately by comparison with similar buildings, the cost of which may be assumed to vary as the cubic contents.

1st class mansions have been found to cost from 9*d.* to **1***s.* per cubic foot, 2nd class from 7*d.* to 8½*d.*, 3rd class from 5*d.* to 6*d.*, and 4th class buildings about 4*d.* The measurement being taken from half-way down the footings, or concrete when there is such, to the top of the ceiling joists of the upper floor, except where there is an attic, in which case half the height of the roof should be included.

Out offices to be taken as 4th class buildings.

The valuer's estimate, when arrived at after this manner, should be reduced if the accomodation is deficient, badly arranged, or unsuitable to the locality, and all buildings should be valued as if in thorough repair, and when they are not so the cost of the repairs should be deducted.

A fair per centage upon this sum, which is the capital supposed to have been expended in the erection of the building, increased by the ground rent, the expense of agent's fees for collecting the rent, the annual sum required to keep the premises in repair, and to insure them against the risk of fire, together with a sum to provide against the loss of rent while the premises are untenanted, the expense of landlord's taxes, and an annual sum to replace the capital at the end of the term (which for a freehold is the natural term of the building, or for a leasehold the expiration of the lease), will give the *gross*

rent at which the premises should be let to a yearly tenant who is not burdened with the repairs.

When practicable, both of these methods should be adopted to arrive at the *gross* annual value. This obtained, the usual deductions can be made, namely :—

For the annual expense of repairs.
" " insurance.
" loss of rent from unoccupied premises or bad tenants.
" landlord's taxes and other burdens charged upon the premises.
" Agent's fees in collecting the rent.

And the result will be the NET ANNUAL VALUE, which is to be capitalized by means of the proper tables.

When the premises are let on lease and under value, the reserved rent will be the gross annual value during the term, but the reversion to the improved rent when the term expires, must also be taken into account.

The ground under buildings should always be considered separately, there being nothing which causes the rent of houses in other respects the same, to vary so much as the value of the land on which they are built, and this value will in a great measure depend upon the healthiness of the locality, freedom of access, and the proximity to a fashionable or business neighbourhood, points which can only be satisfactorily determined by comparison with property similarly situated.

When the ground is held on lease, the rent becomes a deduction from the gross rental received by the owner of the buildings.

THE VALUATION OF PROPERTY TAKEN FOR RAILWAY OR OTHER PURPOSES.

The principles adopted in the valuation of property for an ordinary purchaser, are also applicable to the case of property taken by railway companies and other public bodies under the powers vested in them by the special and other Acts of Parliament bearing on the subject. The valuation, however, in the latter case usually becomes

complicated with the question of compensation for injuries, damage, and inconveniences arising out of the compulsory nature of the proceeding.

The law has defined in general terms for what description of injury compensation has to be made, viz.:

1. The value of the property actually taken.
2. The damage sustained by the owner through severing or otherwise injuriously affecting the property in question.

The value of the lands and buildings required should be ascertained after the manner previously stated, and to it must be added the value of the several rights, privileges, or sources of profit to be taken or destroyed by the proposed undertaking, such as the profits of trade owing to the premises being removed or rendered inapplicable to the further pursuit of that particular branch of business.

Goodwill, or, the name which a tradesman acquires for the business he has conducted.

The loss sustained by a brewer for example, by reason of his tenant not being able to purchase beer from him as stipulated, owing to the premises having been taken away.

And similar interests, which must be valued according to what they would fetch in the general market.

These will constitute the property to be *purchased*, to the capital value of which a sum of money should be added as an acknowledgment of the compulsory nature of the transaction, usually *ten* per cent.

Next, the valuer should proceed to estimate the amount of compensation for damage done to that portion of the property which remains with the owner, such as that arising from severance, and also for damage, &c., as when a mill stream is cut off, the mode of access interfered with, or the frontage value of the property injured, and even for such damage as may be likely to arise after the permanent works have been erected, such as the probability of lands being flooded by the works interfering with the outlet from the natural water shed of the country or otherwise.

The Capital Value.

Having obtained the clear Annual Income derivable from the property under consideration, the next step will be to ascertain the Capital Value or the number of years purchase which it may be expected to realize if offered for sale in the general market, where it will be estimated according to its character as an investment. It is difficult to determine beforehand what per centage a purchaser may expect for his money; but if the selling price is known of any class of securities possessing similar advantages or subject to the same contingencies as the property in question, the capitalization may be effected at the same rate of interest.

The interest usually obtained for money invested in property of the class which we have been describing is shown in the following Table:—

Description.	The Interest which the Property should yield.
Freehold Land	3 to $3\frac{1}{2}$ per cent.
„ Ground Rents	$3\frac{1}{2}$ „ 4 „
„ Country Mansions	4 „ $4\frac{1}{2}$ „
„ Detached Villas in the suburbs of a large town	4 „ $4\frac{1}{2}$ „
„ Town Dwelling Houses, 1st and 2nd class	4 „ $4\frac{1}{2}$ „
„ Ditto, 3rd and 4th class	$4\frac{1}{2}$ „ 5 „
„ Business Premises in a large town, 1st class	4 „ 5 „
„ Ditto ditto, 2nd class	$4\frac{1}{2}$ „ 5 „
„ Labourers' Cottages	$5\frac{1}{2}$ „ 6 „

Leasehold Property being more precarious should return from 1 to 2 per cent. more interest than Freehold, notwithstanding that all contingencies have been allowed for.

Retail Trade is usually estimated at 2 years' purchase.

Ditto in Public Houses or Taverns at $2\frac{1}{2}$ years' purchase.

COPYHOLD PROPERTY is of less value than Freehold by about 5 years' purchase. The proper method of obtaining the value is to deduct the cost of its enfranchisement from the value when treated as a Freehold.

PERPETUITIES.

To Capitalize the Annual Value of a Perpetuity.—Multiply by the number of years' purchase, which will yield the required interest, as in the followiug Table:—

1	per cent. interest	=	100	years' purchase.
$1\frac{1}{2}$	,,	=	75	,,
2	,,	=	50	,,
$2\frac{1}{2}$	,,	=	40	,,
3	,,	=	33.333	,,
$3\frac{1}{2}$	,,	=	28.571	,,
4	,,	=	25	,,
$4\frac{1}{2}$	,,	=	22.222	,,
5	,,	=	20	,,
$5\frac{1}{2}$	,,	=	18.182	,,
6	,,	=	16.667	,,
7	,,	=	14.286	,,
8	,,	=	12.500	,,
9	,,	=	11.111	,,
10	,,	=	10	,,

TERMINABLE ANNUITIES.

To Capitalize the Annual Value of a Leasehold or Terminable Anuuity.—Having determined the class of marketable securities to which the Leasehold or Annuity belongs and the rate of interest which it usually yields, the number of years' purchase will be found in Table IV., in the column under the rate of interest and opposite to the number of years which the Annuity or Leasehold has to run.

The Table provides for the return of the original purchase money at the end of the term, the sinking fund being invested at the same rate of interest as the principal, which in the case of small sums cannot always be done; it will therefore be better in the latter case to use Table V., which supposes a uniform rate of interest of 3 per cent. to be had for the annual sinking fund

Life Annuities or Leases held upon a single life are usually capitalized by Tables VII., XI., or XII., according to whether the Carlisle, Northampton, or English rates of mortality are preferred. The use of any of these Tables, however, is not proper except in very extensive dealings, as the risk on one life is not fairly represented by the average of a number of lives. The simplest mode of treating such cases is that suggested by Mr. Biden in his work on the Valuation of Estates, namely, to insure in some respectable office for the amount of the purchase money, deducting from the annuity beforehand a sufficient sum to pay the annual premium as follows:—

Let p=the annual premium charged for a policy of assurance of £1 on the life, and d=the discount on £1 for one year; then

The price to be given for the annuity$=\frac{1}{p+d}-1$

The annual premium to be paid$=\frac{p}{p+d}$

The amount of the policy required$=\frac{1}{p+d}$

Reversionary Annuities.

To find the present Value of the Reversion to an Annuity of £1, or Freehold in Perpetuity.—From the perpetuity deduct the present value of £1 per annum for the given term or life, as the case may be, found by Tables IV., V., or VII., and the remainder will be the number of years' purchase required.

Example.—The purchase value of the reversion to an annuity of £100 at the end of 30 years at 5 per cent. equals £462.8 or 4.628 years' purchase, and 4.696 years' purchase at the end of a life aged 25.

Note.—The value of the Reversion to an annuity for ever, after the longest of *two* or *three* lives, is found in the same manner by Tables IX. and X.

To find the present Value of the Reversion to an Annuity, Leasehold, or other Property which has only a limited time to run.—From the present value of the

annuity, &c., for the whole term (Tables IV. or V.), deduct the value of the annuity to the commencement of the term in reversion.

Example.—The reversion at the end of ten years to £100 per annum, which has only thirty years to run, is now worth at 5 per cent. £765.1 or 7.651 years' purchase.

To find the Value of the Reversion to an Annuity on one Life after another.—From the value of the life in expectation (Table VII.), deduct that of the two joint lives (Table VIII.), and the remainder will be the number of years' purchase, or value of £1 per annum.

The Renewal of Leases.

To find what Sum ought to be given for renewing any number of years, lapsed or expired in a Lease.—From the value of the whole term of the lease in Table IV. or V., deduct the value in the same table of the unexpired part of the term.

Example.—The sum which a tenant ought to pay for the renewal of ten years lapsed in a lease for twenty years at 5 per cent., is 4.741 years' purchase of the annual value.

To find what Sum ought to be given for renewing with one Life a Lease originally granted for two or more Lives.—From the value of an annuity of £1 on the longest of the original number of lives (Table IX. or X.), deduct the value of an annuity on the longest of the lives in existence, and the remainder will be the number of years' purchase of the annual value.

Church Livings.

To find the Value of the next presentation to a Church Living. — From the value of the successor's life (Table VII.), deduct the joint value of his and the incumbent's life (Table VIII).

Example.—The next presentation to a living is worth 4.32 years' purchase to a clergyman, aged 30, the age of the present incumbent being 50, interest

Note.—The most practical method of dealing with all questions involving life, as we have before stated, is to assume that the risk is to be borne by an Assurance Company.

Annuities Paid Half-Yearly or Quarterly.

The annuities in the Tables and in the foregoing rules are supposed to be paid yearly, but

If paid Half-yearly add .2 years' purchase.
„ Quarterly „ .3 „

Mr. Ashpitel's Equality of Purchase Table.

Years' Purchase.	Annual Income. £	s.	d.	3 per cent.	3½ per cent.	3¾ per cent.	4 per cent.	4½ per cent.	5 per cent.
10	10	0	0	30	35	37½	40	45	50
11	9	1	9	33	38½	41¼	44	49½	55
12	8	6	8	36	42	45	48	54	60
13	7	13	1	39	45½	48¾	52	58½	65
14	7	2	10	42	49	52½	56	63	70
15	6	13	4	45	52½	56¼	60	67½	75
16	6	5	0	48	56	60	64	72	80
17	5	17	8	51	59½	63¾	68	76½	85
18	5	11	1	54	63	67½	72	81	90
19	5	5	3	57	66½	71¼	76	85½	95
20	5	0	0	60	70	75	80	90	100
21	4	15	3	63	73½	78¾	84	94½	105
22	4	10	11	66	77	82½	88	99	110
23	4	6	11	69	80½	86¼	92	103½	115
24	4	3	4	72	84	90	96	108	120
25	4	0	0	75	87½	93¾	100	112½	125
26	3	16	11	78	91	97½	104	117	130
*27	3	14	1	81	94½	101¼	108	121½	135
28	3	11	5	84	98	105	112	126	140
†29	3	9	0	87	101½	108¾	116	130½	145
30	3	6	8	90	105	112½	120	135	150
31	3	4	6	93	108½	116¼	124	139½	155
32	3	2	6	96	112	120	128	144	160
33	3	0	7	99	115½	123¾	132	148½	165
33⅓	3	0	0	100	116⅔	125	133⅓	150	166⅔

1. If I give 27 years' purchase for an estate my income will be the same as if I bought Consols at 81; or $3\frac{1}{2}$ per cents. at $94\frac{1}{2}$; or railway shares paying $4\frac{1}{2}$ per cent. at $121\frac{1}{2}$; or preference shares at 5 per cent. at 135; and each investment would yield £3 14*s.* 1*d.* per cent. as annual income. (See * page 251.)

2. If Consols are at 87, $3\frac{1}{2}$ per cent. ought to be at $101\frac{1}{2}$; any investment which would pay 4 per cent. should be at 116, or which would pay 5 per cent. at 145 or $7\frac{1}{2}$ per cent. (that is double of $3\frac{3}{4}$) at 261, to yield the same annual income, which would be £3 9*s.* per cent. per annum in each, and would be the same thing as buying an estate at 29 years' purchase. (See † page 251.)

3. I see by the newspaper that Consols are at 87 and India 5 per cent. at 105; what is the difference of the interest that each pay?

	Per cent. per annum.		
5 per cent. at 105 pays	£4	15	3
3 ,, 87 ,,	3	9	0
Difference per cent.	£1	6	3

4. I am offered an estate at 30 years' purchase, and sell out of Consols at 93; how much per cent. do I improve my income thereby?

	Per cent. per annum.		
30 years' purchase is	£3	6	8
Consols at 93 ...	3	4	6
Difference per cent.	£0	2	2

Any intermediate half years or difference of prices are easily calculated. The amounts at 6, 7, $7\frac{1}{2}$ per cent. &c., are double those at 3 $3\frac{1}{2}$, $3\frac{3}{4}$ per cent.; and 2, $2\frac{1}{4}$, $2\frac{1}{2}$, &c., per cent. are half of 4, $4\frac{1}{2}$, 5, &c. $5\frac{1}{4}$ per cent. is 3 per cent. added to half $4\frac{1}{2}$. Thus, if Consols are at 87, $5\frac{1}{4}$ per cent. Bank of England Stock should be worth 87, and half $130\frac{1}{2}$; or 87 added to $65\frac{1}{4}$, or $152\frac{1}{4}$; to afford the same rate of annual income, that is, £3 9*s.* per cent per annum.

Formulæ for the Calculation of Compound Interest, and the Value of Annuities for Years certain.

Let

A = The amount to which £1 will increase in any number of years at compound interest (Table I.).

M = The amount to which £1 per annum will increase in any number of years at compound interest (Table II).

r = The rate of interest on a £1 for one year.

$R = 1+r$ or £1 increased by its interest for a year.

S = The annual sinking fund which will amount to £1 in any number of years at compound interest (Table III.)

V = The present value of £1 per annum payable for any number of years at compound interest (Table IV.)

V' = Ditto, ditto, when the purchase money is invested at one rate r, and the sinking-fund S, at another (Table V.).

v = The present value of £1, due at the end of any number of years at compound interest (Table IV.).

n = The number of years or term of the annuity, &c.

$$A = R^n = (1+r)^n$$

$$M = \frac{R^n - 1}{r}$$

$$S = \frac{r}{R^n - 1}$$

$$V = \frac{R^n - 1}{R^n r}$$

$$V' = \frac{1}{S + r}$$

$$v = \frac{1}{R^n}$$

TABLE I.

THE AMOUNT OF ONE POUND AT COMPOUND INTEREST FOR A TERM OF YEARS.

Example.—£100 bearing interest at 5 per Cent. will amount to £265.3 at the end of 20 years.

Interest 2 per Cent.							
Years.	Value.	Years.	Value.	Years.	Value	Years.	Value.
1	1.020	26	1.673	51	2.745	76	4.504
2	1.040	27	1.707	52	2.800	77	4.594
3	1.061	28	1.741	53	2.856	78	4.686
4	1.082	29	1.776	54	2.913	79	4.780
5	1.104	30	1.811	55	2.972	80	4.875
6	1.126	31	1.848	56	3.031	81	4.973
7	1.149	32	1.885	57	3.092	82	5.072
8	1.172	33	1.922	58	3.154	83	5.174
9	1.195	34	1.961	59	3.217	84	5.277
10	1.219	35	2.000	60	3.281	85	5.383
11	1.243	36	2.040	61	3.347	86	5.491
12	1.268	37	2.081	62	3.414	37	5.603
13	1.294	38	2.122	63	3.482	88	5.712
14	1.319	39	2.165	64	3.552	89	5.827
15	1.346	40	2.208	65	3.623	90	5.943
16	1.373	41	2.252	66	3.695	91	6.062
17	1.400	42	2.297	67	3.769	92	6.183
18	1.428	43	2.343	68	3.844	93	6.307
19	1.457	44	2.390	69	3.921	94	6.433
20	1.486	45	2.438	70	4.000	95	6.562
21	1.516	46	2.487	71	4.080	96	6.693
22	1.546	47	2.536	72	4.161	97	6 827
23	1.577	48	2.587	73	4.244	98	6.963
24	1.608	49	2.639	74	4.329	99	7.103
25	1.641	50	2.692	75	4.416	100	7.245

Table I.—The Amount of One Pound, &c.—*continued.*

2½ per Cent.								3 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value
1	1.025	26	1.900	51	3.523	76	6.532	1	1.030	26	2.157	51	4.515	76	9.454
2	1.051	27	1.948	52	3.611	77	6.695	2	1.061	27	2.221	52	4.651	77	9.738
3	1.077	28	1.996	53	3.701	78	6.862	3	1.093	28	2.288	53	4.790	78	10.030
4	1.104	29	2.046	54	3.794	79	7.034	4	1.126	29	2.357	54	4.934	79	10.331
5	1.131	30	2.098	55	3.889	80	7.210	5	1.159	30	2.427	55	5.082	80	10.641
6	1.160	31	2.150	56	3.986	81	7.390	6	1.194	31	2.500	56	5.235	81	10.960
7	1.189	32	2.204	57	4.086	82	7.575	7	1.230	32	2.575	57	5.392	82	11.289
8	1.218	33	2.259	58	4.188	83	7.764	8	1.267	33	2.652	58	5.553	83	11.628
9	1.249	34	2.315	59	4.292	84	7.958	9	1.305	34	2.732	59	5.720	84	11.976
10	1.280	35	2.373	60	4.400	85	8.157	10	1.344	35	2.814	60	5.892	85	12.336
11	1.312	36	2.433	61	4.510	86	8.361	11	1.384	36	2.898	61	6.068	86	12.706
12	1.345	37	2.493	62	4.623	87	8.570	12	1.426	37	2.985	62	6.250	87	13.087
13	1.379	38	2.556	63	4.738	88	8.784	13	1.469	38	3.075	63	6.438	88	13.480
14	1.413	39	2.620	64	4.857	89	9.004	14	1.513	39	3.167	64	6.631	89	13.884
15	1.448	40	2.685	65	4.978	90	9.229	15	1.558	40	3.262	65	6.830	90	14.300
16	1.485	41	2.752	66	5.102	91	9.460	16	1.605	41	3.360	66	7.035	91	14.729
17	1.522	42	2.821	67	5.230	92	9.696	17	1.653	42	3.461	67	7.246	92	15.171
18	1.560	43	2.892	68	5.361	93	9.938	18	1.702	43	3.565	68	7.463	93	15.627
19	1.599	44	2.964	69	5.495	94	10.187	19	1.754	44	3.671	69	7.687	94	16.095
20	1.639	45	3.038	70	5.632	95	10.442	20	1.806	45	3.782	70	7.918	95	16.578
21	1.680	46	3.114	71	5.773	96	10.703	21	1.860	46	3.895	71	8.155	96	17.076
22	1.722	47	3.192	72	5.917	97	10.970	22	1.916	47	4.012	72	8.400	97	17.588
23	1.765	48	3.271	73	6.065	98	11.244	23	1.974	48	4.132	73	8.652	98	18.115
24	1.809	49	3.353	74	6.217	99	11.526	24	2.033	49	4.256	74	8.912	99	18.659
25	1.854	50	3.437	75	6.372	100	11.814	25	2.094	50	4.384	75	9.179	100	19.219

TABLE I.—THE AMOUNT OF ONE POUND, &c.—*continued.*

3½ per Cent.								4 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.035	26	2.446	51	5.780	76	13.660	1	1.040	26	2.772	51	7.391	76	19.703
2	1.071	27	2.532	52	5.983	77	14.139	2	1.082	27	2.883	52	7.687	77	20.491
3	1.109	28	2.620	53	6.192	78	14.633	3	1.125	28	2.999	53	7.994	78	21.311
4	1.148	29	2.712	54	6.409	79	15.146	4	1.170	29	3.119	54	8.314	79	22.163
5	1.188	30	2.807	55	6.633	80	15.676	5	1.217	30	3.243	55	8.646	80	23.050
6	1.229	31	2.905	56	6.865	81	16.224	6	1.265	31	3.373	56	8.992	81	23.972
7	1.272	32	3.007	57	7.106	82	16.792	7	1.316	32	3.508	57	9.352	82	24.931
8	1.317	33	3.112	58	7.354	83	17.380	8	1.369	33	3.648	58	9.726	83	25.928
9	1.363	34	3.221	59	7.612	84	17.988	9	1.423	34	3.794	59	10.115	84	26.965
10	1.411	35	3.334	60	7.878	85	18.618	10	1.480	35	3.946	60	10.520	85	28.044
11	1.460	36	3.450	61	8.154	86	19.269	11	1.539	36	4.104	61	10.940	86	29.165
12	1.511	37	3.571	62	8.439	87	19.944	12	1.601	37	4.268	62	11.378	87	30.332
13	1.564	38	3.696	63	8.735	88	20.642	13	1.665	38	4.439	63	11.833	88	31.545
14	1.619	39	3.825	64	9.040	89	21.364	14	1.732	39	4.616	64	12.306	89	32.807
15	1.675	40	3.959	65	9.357	90	22.112	15	1.801	40	4.801	65	12.799	90	34.119
16	1.734	41	4.098	66	9.684	91	22.886	16	1.873	41	4.993	66	13.311	91	35.484
17	1.795	42	4.241	67	10.023	92	23.687	17	1.948	42	5.193	67	13.843	92	36.903
18	1.857	43	4.390	68	10.374	93	24.516	18	2.026	43	5.400	68	14.397	93	38.380
19	1.923	44	4.543	69	10.737	94	25.374	19	2.107	44	5.617	69	14.973	94	39.915
20	1.990	45	4.702	70	11.113	95	26.262	20	2.191	45	5.841	70	15.572	95	41.511
21	2.059	46	4.867	71	11.502	96	27.182	21	2.279	46	6.075	71	16.194	96	43.172
22	2.132	47	5.037	72	11.904	97	28.133	22	2.370	47	6.318	72	16.842	97	44.899
23	2.206	48	5.214	73	12.321	98	29.118	23	2.465	48	6.571	73	17.516	98	46.695
24	2.283	49	5.396	74	12.752	99	30.137	24	2.563	49	6.833	74	18.217	99	48.562
25	2.363	50	5.585	75	13.199	100	31.191	25	2.666	50	7.107	75	18.945	100	50.505

TABLE I.—THE AMOUNT OF ONE POUND, &c.—*continued.*

4½ per Cent.								5 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.045	26	3.141	51	9.439	76	28.369	1	1.050	26	3.556	51	12.041	76	40.774
2	1.092	27	3.282	52	9.864	77	29.645	2	1.103	27	3.733	52	12.643	77	42.813
3	1.141	28	3.430	53	10.308	78	30.979	3	1.158	28	3.920	53	13.275	78	44.954
4	1.193	29	3.584	54	10.772	79	32.373	4	1.216	29	4.116	54	13.939	79	47.201
5	1.246	30	3.745	55	11.256	80	33.830	5	1.276	30	4.322	55	14.636	80	49.561
6	1.302	31	3.914	56	11.763	81	35.352	6	1.340	31	4.538	56	15.367	81	52.040
7	1.361	32	4.090	57	12.292	82	36.943	7	1.407	32	4.765	57	16.136	82	54.641
8	1.422	33	4.274	58	12.845	83	38.606	8	1.477	33	5.003	58	16.943	83	57.374
9	1.486	34	4.466	59	13.423	84	40.343	9	1.551	34	5.253	59	17.790	84	60.242
10	1.553	35	4.667	60	14.027	85	42.158	10	1.629	35	5.516	60	18.679	85	63.254
11	1.623	36	4.877	61	14.659	86	44.056	11	1.710	36	5.792	61	19.613	86	66.417
12	1.696	37	5.097	62	15.318	87	46.038	12	1.796	37	6.081	62	20.594	87	69.738
13	1.772	38	5.326	63	16.008	88	48.110	13	1.886	38	6.385	63	21.623	88	73.225
14	1.852	39	5.566	64	16.728	89	50.275	14	1.980	39	6.705	64	22.705	89	76.886
15	1.935	40	5.816	65	17.481	90	52.537	15	2.079	40	7.040	65	23.840	90	80.730
16	2.022	41	6.078	66	18.267	91	54.901	16	2.183	41	7.392	66	25.032	91	84.767
17	2.113	42	6.352	67	19.089	92	57.372	17	2.292	42	7.762	67	26.283	92	89.005
18	2.208	43	6.637	68	19.948	93	59.954	18	2.407	43	8.150	68	27.598	93	93.455
19	2.308	44	6.936	69	20.846	94	62.651	19	2.527	44	8.557	69	28.978	94	98.128
20	2.412	45	7.248	70	21.784	95	65.471	20	2.653	45	8.985	70	30.426	95	103.035
21	2.520	46	7.574	71	22.764	96	68.417	21	2.786	46	9.434	71	31.948	96	108.186
22	2.634	47	7.915	72	23.789	97	71.496	22	2.925	47	9.906	72	33.545	97	113.596
23	2.752	48	8.271	73	24.859	98	74.713	23	3.072	48	10.401	73	35.222	98	119.276
24	2.876	49	8.644	74	25.978	99	78.075	24	3.225	49	10.921	74	36.984	99	125.239
25	3.005	50	9.033	75	27.147	100	81.589	25	3.386	50	11.467	75	38.833	100	131.501

TABLE I.—THE AMOUNT OF ONE POUND, &c.—*continued.*

6 per Cent.							
Yrs.	Value	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.060	26	4.549	51	19.525	76	83.800
2	1.124	27	4.822	52	20.697	77	88.828
3	1.191	28	5.112	53	21.939	78	94.158
4	1.262	29	5.418	54	23.255	79	99.808
5	1.338	30	5.743	55	24.650	80	105.796
6	1.419	31	6.088	56	26.129	81	112.144
7	1.504	32	6.453	57	27.697	82	118.872
8	1.594	33	6.841	58	29.359	83	126.005
9	1.689	34	7.251	59	31.120	84	133.565
10	1.791	35	7.686	60	32.988	85	141.579
11	1.898	36	8.147	61	34.967	86	150.074
12	2.012	37	8.636	62	37.065	87	159.078
13	2.133	38	9.154	63	39.289	88	168.623
14	2.261	39	9.704	64	41.646	89	178.740
15	2.397	40	10.286	65	44.145	90	189.465
16	2.540	41	10.903	66	46.794	91	200.832
17	2.693	42	11.557	67	49.601	92	212.882
18	2.854	43	12.250	68	52.577	93	225.655
19	3.026	44	12.985	69	55.732	94	239.195
20	3.207	45	13.765	70	59.076	95	253.546
21	3.400	46	14.590	71	62.620	96	268.759
22	3.604	47	15.466	72	66.378	97	284.885
23	3.820	48	16.394	73	70.360	98	301.978
24	4.049	49	17.378	74	74.582	99	320.096
25	4.292	50	18.420	75	79.057	100	339.302

7 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.070	26	5.807	51	31.519	76	171.07
2	1.145	27	6.214	52	33.725	77	183.04
3	1.225	28	6.649	53	36.086	78	195.86
4	1.311	29	7.114	54	38.612	79	209.56
5	1.403	30	7.612	55	41.315	80	224.23
6	1.501	31	8.145	56	44.207	81	239.93
7	1.606	32	8.715	57	47.302	82	256.73
8	1.718	33	9.325	58	50.613	83	274.70
9	1.838	34	9.978	59	54.156	84	293.93
10	1.967	35	10.677	60	57.946	85	314.50
11	2.105	36	11.424	61	62.003	86	336.52
12	2.252	37	12.224	62	66.343	87	360.97
13	2.410	38	13.079	63	70.987	88	385.28
14	2.579	39	13.995	64	75.956	89	412.25
15	2.759	40	14.974	65	81.273	90	441.10
16	2.952	41	16.023	66	86.962	91	471.93
17	3.159	42	17.144	67	93.049	92	505.02
18	3.380	43	18.344	68	99.563	93	540.37
19	3.617	44	19.628	69	106.532	94	578.20
20	3.870	45	21.202	70	113.989	95	618.67
21	4.141	46	22.473	71	121.969	96	661.98
22	4.430	47	24.046	72	130.506	97	708.32
23	4.741	48	25.729	73	139.642	98	757.90
24	5.072	49	27.530	74	149.417	99	810.95
25	5.427	50	29.457	75	159.876	100	867.72

8 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.080	26	7.396	51	50.65	76	346.90
2	1.166	27	7.988	52	54.71	77	374.65
3	1.260	28	8.627	53	59.08	78	404.63
4	1.360	29	9 317	54	63.81	79	437.00
5	1.469	30	10.063	55	68.91	80	471.95
6	1.587	31	10.868	56	74.43	81	509.71
7	1.714	32	11.737	57	80.38	82	550.49
8	1.851	33	12 676	58	86.81	83	594.53
9	1.999	34	13.690	59	93.76	84	642.09
10	2.159	35	14.785	60	101.26	85	693.46
11	2.332	36	15.968	61	109.36	86	748.93
12	2.518	37	17.246	62	118.11	87	808.85
13	2.720	38	18.625	63	127.55	88	873.56
14	2.937	39	20.115	64	137.76	89	943.44
15	3.172	40	21.725	65	148.78	90	1018.92
16	3.426	41	23.462	66	160.68	91	1100.43
17	3.700	42	25.339	67	173.54	92	1188.46
18	3.996	43	27.367	68	187.42	93	1283.54
19	4.316	44	29.556	69	202.41	94	1386.22
20	4.661	45	31.920	70	218.61	95	1497.12
21	5.034	46	34.474	71	236.09	96	1616.89
22	5.437	47	37.232	72	254.98	97	1746.24
23	5.871	48	40.211	73	275.38	98	1885.94
24	6 341	49	43.427	74	297.41	99	2036.82
25	6.848	50	46.902	75	321.20	100	2199.76

9 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.090	26	9.399	51	81.05	76	698.9
2	1.188	27	10.245	52	88.34	77	761.8
3	1.295	28	11.167	53	96.30	78	830.4
4	1.412	29	12.172	54	104.96	79	905.1
5	1.539	30	13.268	55	114.41	80	986.6
6	1.677	31	14.462	56	124.71	81	1075.3
7	1.828	32	15.763	57	135.93	82	1172.1
8	1.993	33	17.182	58	148.16	83	1277.6
9	2.172	34	18.728	59	161.50	84	1392.6
10	2.367	35	20.414	60	176.03	85	1517.9
11	2.580	36	22.251	61	191.87	86	1654.5
12	2.813	37	24.254	62	209.14	87	1803.5
13	3.066	38	26.437	63	227.97	88	1965.8.
14	3.342	39	28.816	64	248.48	89	2142.7
15	3.643	40	31.409	65	270.85	90	2335 5
16	3.970	41	34.236	66	295.22	91	2545 7
17	4.328	42	37.318	67	321.79	92	2774.8
18	4.717	43	40.676	68	350.75	93	3024.6
19	5.142	44	44.337	69	382.32	94	3296.8
20	5.604	45	48.327	70	416.73	95	3593.5
21	6.109	46	52.677	71	454.24	96	3916.9
22	6.659	47	57.418	72	495.12	97	4269.4
23	7.258	48	62.585	73	539.68	98	4653.7
24	7.911	49	68.218	74	588.25	99	5072.5
25	8.623	50	74.358	75	641.19	100	5529.0

Table I.

The Amount of One Pound, &c.—*continued.*

10 per Cent.							
Years.	Value.	Years.	Value.	Years.	Value.	Years.	Value.
1	1.100	26	11.918	51	129.13	76	1399.1
2	1.210	27	13.110	52	142.04	77	1539.0
3	1.331	28	14.421	53	156.25	78	1692.9
4	1.464	29	15.863	54	171.87	79	1862.2
5	1.611	30	17.449	55	189.06	80	2048.4
6	1.772	31	19.194	56	207.97	81	2253.2
7	1.949	32	21.114	57	228.76	82	2478.6
8	2.144	33	23.225	58	251.64	83	2726.4
9	2.358	34	25.548	59	276.80	84	2999.1
10	2.594	35	28.102	60	304.48	85	3299.0
11	2.853	36	30.913	61	334.93	86	3628.9
12	3.138	37	34.004	62	368.42	87	3991.8
13	3.452	38	37.404	63	405.27	88	4390.9
14	3.797	39	41.145	64	445.79	89	4830.0
15	4.177	40	45.259	65	490.37	90	5313.0
16	4.595	41	49.785	66	539.41	91	5844.3
17	5.054	42	54.764	67	593.35	92	6428.8
18	5.560	43	60.240	68	652.68	93	7071.6
19	6.116	44	66.264	69	717.95	94	7778.8
20	6.727	45	72.890	70	789.75	95	8556.7
21	7.400	46	80.180	71	868.72	96	9412.3
22	8.140	47	88.197	72	955.59	97	10353.6
23	8.954	48	97.017	73	1051.15	98	11388.9
24	9.850	49	106.719	74	1156.27	99	12527.8
25	10.835	50	117.391	75	1271.90	100	13780.6

Table II.

The Amount of One Pound per Annum with Compound Interest at the End of a Term of Years.

Example:—A yearly sum of £10 invested at 5 per Cent. compound interest will accumulate to £330.66 at the end of 20 years.

Interest 2 per Cent.							
Years.	Value.	Years.	Value.	Years.	Value.	Years.	Value.
1	1.000	26	33.671	51	87.271	76	175.208
2	2.020	27	35.344	52	90.016	77	179.712
3	3.060	28	37.051	53	92.817	78	184.306
4	4.122	29	38.792	54	95.673	79	188.992
5	5.204	30	40.568	55	98.587	80	193.772
6	6.308	31	42.379	56	101.558	81	198.647
7	7.434	32	44.227	57	104.589	82	203.620
8	8.583	33	46.112	58	107.681	83	208.693
9	9.755	34	48.034	59	110.835	84	213.867
10	10.950	35	49.994	60	114.052	85	219.144
11	12.169	36	51.994	61	117.333	86	224.527
12	13.412	37	54.034	62	120.679	87	230.017
13	14.680	38	56.115	63	124.093	88	235.618
14	15.974	39	58.237	64	127.575	89	241.330
15	17.293	40	60.402	65	131.126	90	247.157
16	18.639	41	62.610	66	134.749	91	253.100
17	20.012	42	64.862	67	138.444	92	259.162
18	21.412	43	67.159	68	142.213	93	265.345
19	22.841	44	69.503	69	146.057	94	271.652
20	24.297	45	71.893	70	149.978	95	278.085
21	25.783	46	74.331	71	153.977	96	284.647
22	27.299	47	76.817	72	158.057	97	291.340
23	28.845	48	79.354	73	162.218	98	298.166
24	30.422	49	81.941	74	166.463	99	305.130
25	32.030	50	84.579	75	170.792	100	312.232

TABLE II.—THE AMOUNT OF ONE POUND PER ANNUM, &c.—*continued.*

2½ per Cent.

Yrs.	Value.	Yrs	Value.	Yrs.	Value.	Yrs.	Value.
1	1.000	26	36.012	51	100.921	76	221.261
2	2.025	27	37.912	52	104.444	77	227.792
3	3.076	28	39.860	53	108.056	78	234.487
4	4.153	29	41.856	54	111.757	79	241.349
5	5.256	30	43.903	55	115.551	80	248.383
6	6.388	31	46.000	56	119.440	81	255.592
7	7.547	32	48.150	57	123.426	82	262.982
8	8.736	33	50.354	58	127.511	83	270.557
9	9.955	34	52.613	59	131.699	84	278.321
10	11.203	35	54.928	60	135.992	85	286.279
11	12.483	36	57.301	61	140.391	86	294.436
12	13.796	37	59.734	62	144.901	87	302.796
13	15.140	38	62.227	63	149.524	88	311.366
14	16.519	39	64.783	64	154.262	89	320.150
15	17.932	40	67.403	65	159.118	0	329.154
16	19.380	41	70.088	66	164.096	91	338.383
17	20.865	42	72.840	67	169.199	92	347.843
18	22.386	43	75.661	68	174.429	93	357.539
19	23.946	44	78.552	69	179.789	94	367.477
20	25.545	45	81.516	70	185.284	95	377.664
21	27.183	46	84.554	71	190.916	96	388.106
22	28.863	47	87.668	72	196.689	97	398.808
23	30.584	48	90.860	73	202.606	98	409.779
24	32.349	49	94.131	74	208.672	99	421.023
25	34.158	50	97.484	75	214.888	100	432.549

3 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs	Value.	Yrs.	Valu
1	1.000	26	38.553	51	117.181	76	281.8
2	2.030	27	40.710	52	121.696	77	291.2
3	3.091	28	42.931	53	126.347	78	301.0
4	4.184	29	45.219	54	131.137	79	311.0
5	5.309	30	47.575	55	136.072	80	321.3
6	6.468	31	50.003	56	141.154	81	332.0
7	7.662	32	52.503	57	146.388	82	342.9
8	8.892	33	55.078	58	151.780	83	354.2
9	10.159	34	57.730	59	157.333	84	365.8
10	11.464	35	60.462	60	163.053	85	377.8
11	12.808	36	63.276	61	168.945	86	390.1
12	14.192	37	66.174	62	175 013	87	402.8
13	15.618	38	69.159	63	181.264	88	415.9
14	17.086	39	72.234	64	187.702	89	429.4
15	18.599	40	75.401	65	194.333	90	443.3
16	20.157	41	78.663	66	201 163	91	457.6
17	21.762	42	82.023	67	208.198	92	472.3
18	23.414	43	85.484	68	215.444	93	487.5
19	25.117	44	89.048	69	222.907	94	503.1
20	26.870	45	92.720	70	230.594	95	519.2
21	28.676	46	96.501	71	238.512	96	535.8
22	30.537	47	100.397	72	246.667	97	552.9
23	32.453	48	104.408	73	255.067	98	570.5
24	34.426	49	108.541	74	263.719	99	588.6
25	36.459	50	112.797	75	272.631	100	607.2

Table II.—The Amount of One Pound per Annum, &c.—*continued.*

3½ per Cent.								4 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.000	26	41.313	51	136 583	76	361.729	1	1.000	26	44.312	51	159.774	76	467.577
2	2.035	27	43.759	52	142.363	77	375.389	2	2.040	27	47.084	52	167.165	77	487.280
3	3.106	28	46.291	53	148.346	78	389.528	3	3.122	28	49.968	53	174.851	78	507.771
4	4.215	29	48.911	54	154.538	79	404.161	4	4.246	29	52.966	54	182.845	79	529.082
5	5.362	30	51.623	55	160.947	80	419.307	5	5.416	30	56.085	55	191.159	80	551.245
6	6.550	31	54.429	56	167.580	81	434.983	6	6.633	31	59.328	56	199.806	81	574.295
7	7.779	32	57.335	57	174.445	82	451.207	7	7.898	32	62.701	57	208.798	82	598.267
8	9.052	33	60.341	58	181.551	83	467.999	8	9.214	33	66.210	58	218.150	83	623.197
9	10.368	34	63.453	59	188.905	84	485.379	9	10.583	34	69.858	59	227.876	84	649.125
10	11.731	35	66.674	60	196.517	85	503.367	10	12.006	35	73 652	60	237.991	85	676.090
11	13.142	36	70.008	61	204.395	86	521.985	11	13.486	36	77.598	61	248.510	86	704.134
12	14.602	37	73.458	62	212.549	87	541.255	12	15.026	37	81.702	62	259.451	87	733.299
13	16.113	38	77.029	63	220.988	88	561.199	13	16.627	38	85.970	63	270.829	88	763.631
14	17.677	39	80.725	64	229.723	89	581.841	14	18.292	39	90.409	64	282.662	89	795.176
15	19.296	40	84.550	65	238.763	90	603.205	15	20.024	40	95.026	65	294.968	90	827.983
16	20.971	41	88.510	66	248.120	91	625.317	16	21.825	41	99.827	66	307.767	91	862.103
17	22.705	42	92.607	67	257.804	92	648.203	17	23.698	42	104.820	67	321.078	92	897.587
18	24.500	43	96.849	68	267.827	93	671.890	18	25.645	43	110.012	68	334.921	93	934.490
19	26.357	44	101.238	69	278.201	94	696.407	19	27.671	44	115.413	69	349.318	94	972.870
20	28.280	45	105.782	70	288.938	95	721.781	20	29.778	45	121.029	70	364.290	95	1012.785
21	30.269	46	110.484	71	300.051	96	748.043	21	31.969	46	126.871	71	379.862	96	1054.296
22	32.329	47	115.351	72	311.553	97	775.225	22	34.248	47	132.945	72	396.057	97	1097.468
23	34.460	48	120.388	73	323.457	98	803.358	23	36.618	48	139.263	73	412.899	98	1142.367
24	36.667	49	125.602	74	335.778	99	832.475	24	39.083	49	145.834	74	430.415	99	1189.061
25	38.950	50	130.998	75	348.530	100	862.612	25	41.646	50	152.667	75	448.631	100	1237.624

Table II.—The Amount of One Pound per Annum, &c.—*continued.*

4½ per Cent.								5 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.000	26	47.571	51	187.536	76	608.191	1	1.000	26	51.113	51	220.815	76	795.486
2	2.045	27	50.711	52	196.975	77	636.560	2	2.050	27	54.669	52	232.856	77	836.261
3	3.137	28	53.993	53	206.839	78	666.205	3	3.153	28	58.403	53	245.499	78	879.074
4	4.278	29	57.423	54	217.146	79	697.184	4	4.310	29	62.323	54	258.774	79	924.027
5	5.471	30	61.007	55	227.918	80	729.558	5	5.526	30	66.439	55	272.713	80	971.229
6	6.717	31	64.752	56	239.174	81	763.388	6	6.802	31	70.761	56	287.348	81	1020.790
7	8.019	32	68.666	57	250.937	82	798.740	7	8.142	32	75.299	57	302.716	82	1072.830
8	9.380	33	72.756	58	263.229	83	835.684	8	9.549	33	80.064	58	318.851	83	1127.471
9	10.802	34	77.030	59	276.075	84	874.289	9	11.027	34	85,067	59	335.794	84	1184.845
10	12.288	35	81.497	60	289.498	85	914.632	10	12.578	35	90.320	60	353.584	85	1245.087
11	13.841	36	86.164	61	303.525	86	956.791	11	14.207	36	95.836	61	372.263	86	1308.341
12	15.464	37	91.041	62	318.184	87	1000.846	12	15.917	37	101.628	62	391.876	87	1374.758
13	17.160	38	96.138	63	333.502	88	1046.884	13	17.713	38	107.710	63	412.470	88	1444.496
14	18.932	39	101.464	64	349.510	89	1094.994	14	19.599	39	114.095	64	434.093	89	1517.721
15	20.784	40	107.030	65	366.238	90	1145.269	15	21.579	40	120.800	65	456.798	90	1594.607
16	22.719	41	112.847	66	383.719	91	1197.806	16	23.657	41	127.840	66	480.638	91	1675.338
17	24.742	42	118.925	67	401.986	92	1252.707	17	25.840	42	135.232	67	505.670	92	1760.105
18	26.855	43	125.276	68	421.075	93	1310.079	18	28.132	43	142.993	68	531.953	93	1849.110
19	29.064	44	131.914	69	441.024	94	1370.033	19	30.539	44	151.143	69	559.551	94	1942.565
20	31.371	45	138.850	70	461.870	95	1432.684	20	33.066	45	159.700	70	588.529	95	2040.694
21	33.783	46	146.098	71	483.654	96	1498.155	21	35.719	46	168.685	71	618.955	96	2143.728
22	36.303	47	153.673	72	506.418	97	1566.572	22	38.505	47	178.119	72	650.903	97	2251.915
23	38.937	48	161.588	73	530.207	98	1638.068	23	41.430	48	188.025	73	684.448	98	2365.510
24	41.689	49	169.859	74	555.066	99	1712.781	24	44.502	49	198.427	74	719.670	99	2484.786
25	44.565	50	178.503	75	581.044	100	1790.856	25	47.727	50	209.348	75	756.654	100	2610.025

Table II.—The Amount of One Pound per Annum, &c.—*continued.*

6 per Cent.								7 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.000	26	59.156	51	308.756	76	1380.006	1	1.000	26	68.676	51	435.986	76	2429.53
2	2.060	27	63.706	52	328.281	77	1463.806	2	2.070	27	74.484	52	467.505	77	2600.60
3	3.184	28	68.528	53	348.978	78	1552.634	3	3.215	28	80.698	53	501.230	78	2783.64
4	4.375	29	73.640	54	370.917	79	1646.792	4	4.440	29	87.347	54	537.316	79	2979.50
5	5.637	30	79.058	55	394.172	80	1746.600	5	5.751	30	94.461	55	575.929	80	3189.06
6	6.975	31	84.802	56	418.822	81	1852.396	6	7.153	31	102.073	56	617.244	81	3413.30
7	8.394	32	90.890	57	444.952	82	1964.540	7	8.654	32	110.218	57	661.451	82	3653.23
8	9.897	33	97.343	58	472.649	83	2083.412	8	10.260	33	118.933	58	708.752	83	3909.95
9	11.491	34	104.184	59	502.008	84	2209.417	9	11.978	34	128.259	59	759.365	84	4184.65
10	13.181	35	111.435	60	533.128	85	2342.982	10	13.816	35	138.237	60	813.520	85	4478.58
11	14.972	36	119.121	61	566.116	86	2484.561	11	15.784	36	148.913	61	871.467	86	4793.08
12	16.870	37	127.268	62	601.083	87	2634.634	12	17.888	37	160.337	62	933.469	87	5129.59
13	18.882	38	135.904	63	638.148	88	2793.712	13	20.141	38	172.561	63	999.812	88	5489.66
14	21.015	39	145.058	64	677.437	89	2962.335	14	22.550	39	185.640	64	1070.799	89	5874.94
15	23.276	40	154.762	65	719.083	90	3141.075	15	25.129	40	199.635	65	1146.755	90	6287.19
16	25.673	41	165.048	66	763.228	91	3330.540	16	27.888	41	214.610	66	1228.028	91	6728.29
17	28.213	42	175.951	67	810.022	92	3531.372	17	30.840	42	230.632	67	1314.990	92	7200.27
18	30.906	43	187.508	68	859.623	93	3744.254	18	33.999	43	247.776	68	1408.039	93	7705.29
19	33.760	44	199.758	69	912.200	94	3969.910	19	37.379	44	266.121	69	1507.602	94	8245.66
20	36.786	45	212.744	70	967.932	95	4209.104	20	40.995	45	285.749	70	1614.134	95	8823.85
21	39.993	46	226.508	71	1027.008	96	4462.651	21	44.865	46	306.752	71	1728.124	96	9442.52
22	43.392	47	241.099	72	1089.629	97	4731.410	22	49.006	47	329.224	72	1850.092	97	10104.50
23	46.996	48	256.565	73	1156.006	98	5016.294	23	53.436	48	353.270	73	1980.599	98	10812.81
24	50.816	49	272.958	74	1226.367	99	5318.272	24	58.177	49	378.999	74	2120.241	99	11570.71
25	54.865	50	290.336	75	1300.949	100	5638.368	25	63.249	50	406.529	75	2269.657	100	12381.66

TABLE II.—THE AMOUNT OF ONE POUND PER ANNUM, &c.—*continued.*

8 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.000	26	79.954	51	620.672	76	4323.76
2	2.080	27	87.351	52	671.326	77	4670.66
3	3.246	28	95.339	53	726.032	78	5045.32
4	4.506	29	103.966	54	785.114	79	5449.94
5	5.867	30	113.283	55	848.923	80	5886.94
6	7.336	31	123.346	56	917.837	81	6358.89
7	8.923	32	134.214	57	992.264	82	6868.60
8	10.637	33	145.951	58	1072.645	83	7419.09
9	12.488	34	158.627	59	1159.457	84	8013.62
10	14.487	35	172.317	60	1253.213	85	8655.71
11	16.645	36	187.102	61	1354.470	86	9349.16
12	18.977	37	203.070	62	1463.828	87	10098.10
13	21.495	38	220.316	63	1581.934	88	10906.94
14	24.215	39	238.941	64	1709.489	89	11780.50
15	27.152	40	259.057	65	1847.248	90	12723.94
16	30.324	41	280.781	66	1996.028	91	13742.85
17	33.750	42	304.244	67	2156.710	92	14843.28
18	37.450	43	329.583	68	2330.247	93	16031.74
19	41.446	44	356.950	69	2517.667	94	17315.28
20	45.762	45	386.506	70	2720.080	95	18701.51
21	50.423	46	418.426	71	2938.686	96	20198.63
22	55.457	47	452.900	72	3174.781	97	21815.52
23	60.893	48	490.132	73	3429.764	98	23561.76
24	66.765	49	530.343	74	3705.145	99	25447.70
25	73.106	50	573.770	75	4002.557	100	27484.52

9 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value	Yrs.	Value.
1	1.000	26	93.32	51	889.44	76	7754.4
2	2.090	27	102.72	52	970.49	77	8453.3
3	3.278	28	112.97	53	1058.83	78	9215.1
4	4.573	29	124.14	54	1155.13	79	10045.5
5	5.985	30	136.31	55	1260.09	80	10950.6
6	7.523	31	149.58	56	1374.50	81	11937.1
7	9.200	32	164.04	57	1499.21	82	13012.5
8	11.029	33	179.80	58	1635.13	83	14184.6
9	13.021	34	196.98	59	1783.30	84	15462.2
10	15.193	35	215.71	60	1944.79	85	16854.8
11	17.560	36	236.12	61	2120.82	86	18372.7
12	20.141	37	258.38	62	2312.70	87	20027.3
13	22.953	38	282.63	63	2521.84	88	21830.7
14	26.019	39	309.07	64	2749.81	89	23796.5
15	29.361	40	337.88	65	2998.29	90	25939.2
16	33.003	41	369.29	66	3269.13	91	28274.7
17	36.974	42	403.53	67	3564.36	92	30820.4
18	41.301	43	440.85	68	3886.15	93	33595.3
19	46.019	44	481.52	69	4236.90	94	36619.8
20	51.160	45	525.86	70	4619.22	95	39916.6
21	56.765	46	574.19	71	5035.95	96	43510.1
22	62.873	47	626.86	72	5490.19	97	47427.0
23	69.532	48	684.28	73	5985.31	98	51696.5
24	76.790	49	746.87	74	6524.98	99	56350.2
25	84.701	50	815.08	75	7113.23	100	61422.7

Table II.

The Amount of One Pound per Annum, &c. (*continued.*)

10 per Cent.							
Years.	Value.	Years.	Value.	Years.	Value.	Years.	Value.
1	1.000	26	109.18	51	1281.3	76	13980.8
2	2.100	27	121.10	52	1410.4	77	15379.9
3	3.310	28	134.21	53	1552.5	78	16918.9
4	4.641	29	148.63	54	1708.7	79	18611.8
5	6.105	30	164.49	55	1880.6	80	20474.0
6	7.716	31	181.94	56	2069.7	81	22522.4
7	9.487	32	201.14	57	2277.6	82	24775.6
8	11.436	33	222.25	58	2506.4	83	27254.2
9	13.579	34	245.48	59	2758.0	84	29980.6
10	15.937	35	271.02	60	3034.8	85	32979.7
11	18.531	36	299.13	61	3339.3	86	36278.7
12	21.384	37	330.04	62	3674.2	87	39907.5
13	24.523	38	364.04	63	4042.7	88	43899.3
14	27.975	39	401.45	64	4447.9	89	48290.2
15	31.772	40	442.59	65	4893.7	90	53120.2
16	35.950	41	487.85	66	5384.1	91	58433.2
17	40.545	42	537.64	67	5923.5	92	64277.6
18	45.599	43	592.40	68	6516.8	93	70706.3
19	51.159	44	652.64	69	71[illegible]9.5	94	77778.0
20	57.275	45	718.90	70	7887.5	95	85556.8
21	64.002	46	791.80	71	8677.2	96	94113.4
22	71.403	47	871.97	72	9545.9	97	103525.8
23	79.543	48	960.17	73	10501.5	98	113879.4
24	88.497	49	1057.19	74	11552.7	99	125268.3
25	98.347	50	1163.91	75	12709.0	100	137796.1

TABLE III.

THE ANNUAL RESERVED OR SINKING FUND THAT WITH COMPOUND INTEREST WILL AMOUNT TO ONE POUND AT THE END OF A TERM OF YEARS.

Example.—To provide against the expiration of a lease which has 20 years to run, and for which £100 has been paid, it will be necessary to invest £3.02 per annum at 5 per cent. compound interest to accumulate to that sum.

Interest 3 per Cent.							
Years	Value	Years.	Value.	Years.	Value.	Years.	Value.
1	1.0000	26	.0259	51	.0085	76	.0035
2	.4926	27	.0246	52	.0082	77	.0034
3	.3235	28	.0233	53	.0079	78	.0033
4	.2390	29	.0221	54	.0076	79	.0032
5	.1884	30	.0210	55	.0073	80	.0031
6	.1546	31	.0200	56	.0071	81	.0030
7	.1305	32	.0190	57	.0068	82	.0029
8	.1125	33	.0182	58	.0066	83	.0028
9	.0984	34	.0173	59	.0064	84	.0027
10	.0872	35	.0165	60	.0061	85	.0026
11	.0781	36	.0158	61	,0059	86	.0026
12	.0705	37	.0151	62	.0057	87	.0025
13	.0640	38	.0145	63	.0055	88	.0024
14	.0585	39	.0138	64	.0053	89	.0023
15	.0538	40	.0133	65	.0051	90	.0023
16	.0496	41	.0127	66	.0050	91	.0022
17	.0460	42	.0122	67	.0048	92	.0021
18	.0427	43	.0117	68	.0046	93	.0021
19	0398	44	.0112	69	.0045	94	.0020
20	.0372	45	.0108	70	.0043	95	.0019
21	.0349	46	.0104	71	.0042	96	.0019
22	.0327	47	.0100	72	.0041	97	.0018
23	.0308	48	.0096	73	.0039	98	.0018
24	.0290	49	.0092	74	.0038	99	.0017
25	.0274	50	.0089	75	.0037	100	.0016

Table III.—The Annual Reserved Fund, &c.—*continued.*

$3\frac{3}{4}$ per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.0000	26	.0251	51	.0079	76	.0031
2	.4920	27	.0237	52	.0076	77	.0030
3	.3227	28	.0224	53	.0073	78	.0029
4	.2381	29	.0213	54	.0070	79	.0028
5	.1874	30	.0202	55	.0067	80	.0027
4	.1536	31	.0192	56	.0065	81	.0026
7	.1295	32	.0182	57	.0062	82	.0025
8	.1115	33	.0173	58	.0060	83	.0025
9	.0974	34	.0165	59	.0058	84	.0024
10	.0862	35	.0157	60	.0056	85	.0023
11	.0771	36	.0150	61	.0054	86	.0022
12	.0695	37	.0143	62	.0052	87	.0021
13	.0630	38	.0137	63	.0049	88	.0021
14	.0575	39	.0131	64	.0048	89	.0020
15	.0528	40	.0125	65	.0046	90	.0019
16	.0486	41	.0120	66	.0045	91	.0019
17	.0450	42	.0115	67	.0043	92	.0018
18	.0417	43	.0110	68	.0042	93	.0017
19	.0389	44	.0105	69	.0040	94	.0017
20	.0363	45	.0101	70	.0039	95	.0016
21	.0339	46	.0097	71	.0037	96	.0015
22	.0318	47	.0093	72	.0036	97	.0015
23	.0299	48	.0089	73	0035	98	.0014
24	.0281	49	.0086	74	0033	99	.0014
25	.0265	50	.0082	75	.0033	100	.0014

$3\frac{1}{2}$ per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.0000	26	.0242	51	.0073	76	.0028
2	.4914	27	.0229	52	.0070	77	.0027
3	.3219	28	.0216	53	.0067	78	.0026
4	.2373	29	.0204	54	.0065	79	.0025
5	.1865	30	.0194	55	.0062	80	.0024
6	.1527	31	.0184	56	.0060	81	.0023
7	.1285	32	.0174	57	.0057	82	.0022
8	.1105	33	.0166	58	.0055	83	.0021
9	.0964	34	.0158	59	.0053	84	.0021
10	.0852	35	.0150	60	.0051	85	.0020
11	.0761	36	.0143	61	.0049	86	.0019
12	.0685	37	.0136	62	.0047	87	.0019
13	.0621	38	.0130	63	.0045	88	.0018
14	.0566	39	.0124	64	.0044	89	.0017
15	.0518	40	.0118	65	.0042	90	.0017
16	.0477	41	.0113	66	.0040	91	.0016
17	.0440	42	.0108	67	.0039	92	.0015
18	.0408	43	.0103	68	.0037	93	.0015
19	.0379	44	.0099	69	.0036	94	.0014
20	.0354	45	.0095	70	.0035	95	.0014
21	.0330	46	.0091	71	.0033	96	.0013
22	.0309	47	.0087	72	.0032	97	.0013
23	.0290	48	.0083	73	.0031	98	.0012
24	.0273	49	.0080	74	.0030	99	.0012
25	.0257	50	.0076	75	.0029	100	.0012

Table III.—The Annual Reserved Fund, &c.—*continued.*

4 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value
1	1.0000	26	.0226	51	.0063	76	.0021
2	4902	27	.0212	52	.0060	77	.0021
3	.3204	28	.0200	53	.0057	78	.0020
4	.2355	29	.0189	54	.0055	79	0019
5	.1846	30	.0178	55	.0052	80	.0018
6	.1508	31	.0169	56	.0050	81	.0017
7	.1266	32	.0160	57	.0048	82	.0017
8	.1085	33	.0151	58	.0046	83	.0016
9	.0945	34	.0143	59	.0044	84	.0015
10	.0833	35	.0136	60	.0042	85	.0015
11	.0742	36	.0129	61	.0040	86	.0014
12	.0666	37	.0122	62	.0039	87	.0014
13	.0601	38	.0116	63	.0037	88	.0013
14	.0547	39	.0111	64	.0035	89	.0013
15	.0499	40	.0105	65	.0034	90	.0012
16	.0458	41	.0100	66	.0033	91	.0012
17	.0422	42	.0095	67	.0031	92	.0011
18	.0390	43	.0091	68	.0030	93	.0011
19	.0361	44	.0087	69	.0029	94	.0010
20	.0336	45	.0083	70	.0027	95	.0010
21	.0313	46	.0079	71	.0026	96	.0010
22	.0292	47	.0075	72	.0025	97	.0009
23	.0273	48	.0072	73	.0024	98	.0009
24	.0256	49	.0069	74	.0023	99	.0008
25	.0240	50	.0066	75	.0022	100	0008

4½ per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value
1	1.0000	26	.0210	51	.0053	76	.0016
2	.4890	27	.0197	52	.0051	77	.0016
3	.3188	28	.0185	53	.0048	78	.0015
4	.2337	29	.0174	54	.0046	79	.0014
5	.1828	30	.0164	55	.0044	80	.0014
6	.1489	31	.0154	56	.0042	81	.0013
7	.1247	32	.0146	57	.0040	82	.0013
8	.1066	33	.0137	58	.0038	83	.0012
9	.0926	34	.0130	59	.0036	84	.0011
10	.0814	35	.0123	60	.0035	85	.0011
11	.0723	36	.0116	61	.0033	86	.0010
12	.0647	37	.0110	62	.0031	87	.0010
13	.0583	38	.0104	63	.0030	88	.0010
14	.0528	39	.0099	64	.0029	89	.0009
15	.0481	40	.0093	65	.0027	90	.0009
16	.0440	41	.0089	66	.0026	91	.0008
17	.0404	42	.0084	67	.0025	92	.0008
18	.0372	43	.0080	68	.0024	93	.0008
19	.0344	44	.0076	69	.0023	94	.0007
20	.0319	45	.0072	70	.0022	95	.0007
21	.0296	46	.0068	71	.0021	96	.0007
22	.0275	47	.0065	72	.0020	97	.0006
23	.0257	48	.0062	73	.0019	98	.0006
24	.0240	49	.0059	74	.0018	99	.0006
25	.0224	50	.0056	75	.0017	100	.0006

5 per Cent.								6 per Cent.							
Yrs.	Value	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs,	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value
1	1.0000	26	.0196	51	.0045	76	.0013	1	1.0000	26	.0169	51	.0032	76	.0007
2	.4878	27	.0183	52	.0043	77	.0012	2	.4854	27	.0157	52	.0030	77	.0007
3	.3172	28	.0171	53	.0041	78	.0011	3	.3141	28	.0146	53	.0029	78	.0006
4	.2320	29	.0160	54	.0039	79	.0011	4	.2286	29	.0136	54	.0027	79	.0006
5	.1810	30	.0151	55	.0037	80	.0010	5	.1774	30	.0126	55	.0025	80	.0006
6	.1470	31	.0141	56	.0035	81	.0010	6	.1434	31	.0118	56	.0024	81	.0005
7	.1228	32	.0133	57	.0033	82	.0009	7	.1191	32	.0110	57	.0022	82	.0005
8	.1047	33	.0125	58	.0031	83	.0009	8	.1010	33	.0103	58	.0021	83	.0005
9	.0907	34	.0118	59	.0030	84	.0008	9	.0870	34	.0096	59	.0020	84	.0005
10	.0795	35	.0111	60	.0028	85	.0008	10	.0759	35	.0090	60	.0019	85	.0004
11	.0704	36	.0104	61	.0027	86	.0008	11	.0668	36	.0084	61	.0018	86	.0004
12	.0628	37	.0098	62	.0026	87	.0007	12	.0593	37	.0079	62	.0017	87	.0004
13	.0565	38	.0093	63	.0024	88	.0007	13	.0530	38	.0074	63	.0016	88	.0004
14	.0510	39	.0088	64	.0023	89	.0007	14	.0476	39	.0069	64	.0015	89	.0003
15	.0463	40	.0083	65	.0022	90	.0006	15	.0430	40	.0065	65	.0014	90	.0003
16	.0423	41	.0078	66	.0021	91	.0006	16	.0390	41	.0061	66	.0013	91	.0003
17	.0387	42	.0074	67	.0020	92	.0006	17	.0354	42	.0057	67	.0012	92	.0003
18	.0355	43	.0070	68	.0019	93	.0005	18	.0324	43	.0053	68	.0012	93	.0003
19	.0327	44	.0066	69	.0018	94	.0005	19	.0296	44	.0050	69	.0011	94	.0003
20	.0302	45	.0063	70	.0017	95	.0005	20	.0272	45	.0047	70	.0010	95	.0002
21	.0280	46	.0059	71	.0016	96	.0005	21	.0250	46	.0044	71	.0010	96	.0002
22	.0260	47	.0056	72	.0015	97	.0004	22	.0230	47	.0041	72	.0009	97	.0002
23	.0241	48	.0053	73	.0015	98	.0004	23	.0213	48	.0039	73	.0009	98	.0002
24	.0225	49	.0050	74	.0014	99	.0004	24	.0197	49	.0037	74	.0008	99	.0002
25	.0210	50	.0048	75	.0013	100	.0004	25	.0182	50	.0034	75	.0008	100	.0002

TABLE III.—THE ANNUAL RESERVED FUND, &c.—*continued.*

7 per Cent.

Yrs.	Value	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.0000	26	.0146	51	.0023	76	.0004
2	.4831	27	.0134	52	.0021	77	.0004
3	.3111	28	.0124	53	.0020	78	.0004
4	.2252	29	.0114	54	.0019	79	.0003
5	.1739	30	.0106	55	.0017	80	.0003
6	.1398	31	.0098	56	.0016	81	.0003
7	.1156	32	.0091	57	.0015	82	.0003
8	.0975	33	.0084	58	.0014	83	.0003
9	.0835	34	.0078	59	.0013	84	.0002
10	.0724	35	.0072	60	.0012	85	.0002
11	.0634	36	.0067	61	.0011	86	.0002
12	.0559	37	.0062	62	.0011	87	.0002
13	.0497	38	.0058	63	.0010	88	.0002
14	.0443	39	.0054	64	.0009	89	.0002
15	.0398	40	.0050	65	.0009	90	.0002
16	.0359	41	.0047	66	.0008	91	.0001
17	.0324	42	.0043	67	.0008	92	.0001
18	.0294	43	.0040	68	.0007	93	.0001
19	.0268	44	.0038	69	.0007	94	.0001
20	.0244	45	.0035	70	.0006	95	.0001
21	.0223	46	.0033	71	.0006	96	.0001
22	.0204	47	.0030	72	.0005	97	.0001
23	.0187	48	.0028	73	.0005	98	.0001
24	.0172	49	.0026	74	.0005	99	.0001
25	.0158	50	.0025	75	.0004	100	.0001

8 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	1.0000	26	.0125	51	.0016	76	.0002
2	.4808	27	.0114	52	.0015	77	.0002
3	.3080	28	.0105	53	.0014	78	.0002
4	.2219	29	.0096	54	.0013	79	.0002
5	.1705	30	.0088	55	.0012	80	.0002
6	.1363	31	.0081	56	.0011	81	.0002
7	.1121	32	.0075	57	.0010	82	.0001
8	.0940	33	.0069	58	.0009	83	.0001
9	.0801	34	.0063	59	.0009	84	.0001
10	.0690	35	.0058	60	.0008	85	.0001
11	.0601	36	.0053	61	.0007	86	.0001
12	.0527	37	.0049	62	.0007	87	.0001
13	.0465	38	.0045	63	.0006	88	.0001
14	.0413	39	.0042	64	.0006	89	.0001
15	.0368	40	.0039	65	.0005	90	.0001
16	.0330	41	.0036	66	.0005	91	.0001
17	.0296	42	.0033	67	.0005	92	.0001
18	.0267	43	.0030	68	.0004	93	.0001
19	.0241	44	.0028	69	.0004	94	.0001
20	.0219	45	.0026	70	.0004	95	.0001
21	.0198	46	.0024	71	.0003	96	.0001
22	.0180	47	.0022	72	.0003	97	.0001
23	.0164	48	.0020	73	.0003	98	.0001
24	.0150	49	.0019	74	.0003	99	.0001
25	.0137	50	.0017	75	.0002	100	.0001

Table IV.

The Present Value of One Pound per Annum Payable for a Term of Years. The Sinking Fund and Purchase Money being invested at the same rate of Interest.

Example.—An Estate, Lease, or Annuity, held for 20 years is worth at the present time 12.462 years' purchase if the purchaser expects 5 per cent. for his money.

Interest 2 per Cent.

Years.	Value.	Years.	Value.	Years.	Value.	Years.	Value.
1	.980	26	20.121	51	31.788	76	38.899
2	1.942	27	20.707	52	32.145	77	39.117
3	2.884	28	21.281	53	32.495	78	39.330
4	3.808	29	21.844	54	32.838	79	39.539
5	4.713	30	22.396	55	33.175	80	39.745
6	5.601	31	22.938	56	33.505	81	39.946
7	6.472	32	23.468	57	33.828	82	40.143
8	7.325	33	23.989	58	34.145	83	40.336
9	8.162	34	24.499	59	34.456	84	40.526
10	8.983	35	24.999	60	34.761	85	40.711
11	9.787	36	25.489	61	35.060	86	40.893
12	10.575	37	25.969	62	35.353	87	41.072
13	11.348	38	26.441	63	35.640	88	41.247
14	12.106	39	26.903	64	35.921	89	41.419
15	12.849	40	27.355	65	36.197	90	41.587
16	13.578	41	27.799	66	36.468	91	41.752
17	14.292	42	28.235	67	36.733	92	41.914
18	14.992	43	28.662	68	36.994	93	42.072
19	15.679	44	29.080	69	37.249	94	42.228
20	16.351	45	29.490	70	37.499	95	42.380
21	17.011	46	29.892	71	37.744	96	42.529
22	17.658	47	30.287	72	37.984	97	42.676
23	18 292	48	30.673	73	38.220	98	42.820
24	18.914	49	31.052	74	38.451	99	42.960
25	19.523	50	31.424	75	38.677	100	43.098

TABLE IV.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

2½ per Cent.								3 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yr	Value.	Yrs.	Value.	Yrs.	Value.
1	.976	26	18.951	51	28.646	76	33.876	1	.971	26	17.877	51	25.951	76	29.808
2	1.927	27	19.464	52	28.923	77	34.025	2	1.913	27	18.327	52	26.166	77	26.910
3	2.856	28	19.965	53	29.193	78	34.171	3	2.829	28	18.764	53	26 375	78	30.010
4	3.762	29	20.454	54	29.457	79	34.313	4	3.717	29	19.188	54	26.578	79	30.107
5	4.646	30	20.930	55	29.714	80	34.452	5	4.580	30	19.600	55	26.774	80	30.201
6	5.508	31	21.395	56	29.965	81	34.587	6	5.417	31	20.000	56	26.965	81	30.292
7	6.349	32	21.849	57	30.210	82	34.719	7	6.230	32	20.389	57	27.151	82	30.381
8	7.170	33	22.292	58	30.448	83	34.848	8	7.020	33	20.766	58	27.331	83	30.467
9	7.971	34	22.724	59	30.681	84	34.974	9	7.786	34	21.132	59	27.506	84	30 550
10	8.752	35	23.145	60	30.909	85	35.096	10	8.530	35	21.487	60	27.676	85	30.631
11	9.514	36	23.556	61	31.130	86	35.216	11	9.253	36	21.832	61	27.840	86	30.710
12	10.258	37	23.957	62	31.347	87	35.333	12	9.954	37	22.167	62	28.000	87	30.786
13	10.983	38	24.349	63	31.558	88	35.446	13	10.635	38	22.492	63	28.156	88	30.860
14	11.691	39	24.730	64	31.764	89	35.557	14	11.296	39	22.808	64	28.306	89	30.932
15	12.381	40	25.103	65	31.965	90	35.666	15	11.938	40	23.115	65	28.453	90	31.002
16	13.055	41	25.466	66	32.161	91	35.771	16	12.561	41	23.412	66	28.595	91	31.070
17	13.712	42	25.821	67	32.352	92	35.875	17	13.166	42	23.701	67	28.733	92	31.136
18	14.353	43	26.166	68	32.538	93	35.975	18	13.754	43	23.982	68	28.867	93	31.200
19	14.979	44	26.504	69	32.720	94	36.073	19	14.324	44	24.254	69	28.997	94	31.262
20	15.589	45	26.833	70	32.898	95	36.169	20	14.877	45	24.519	70	29.123	95	31.323
21	16.185	46	27.154	71	33.071	96	36.263	21	15.415	46	24.775	71	29.246	96	31.381
22	16.765	47	27.467	72	33.240	97	36.354	22	15.937	47	25.025	72	29.365	97	31.438
23	17.332	48	27.773	73	33.405	98	36.443	23	16.444	48	25.267	73	29.481	98	31.493
24	17.885	49	28.071	74	33.566	99	36.529	24	16 936	49	25.502	74	29.593	99	31.547
25	18.424	50	28.362	75	33.723	100	36.614	25	17.413	50	25.730	75	29.702	100	31.599

TABLE IV.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

3½ per Cent.

Yrs	Value.	Yrs.	Value	Yrs.	Value.	Yrs.	Value.
1	.966	26	16.890	51	23.629	76	26.480
2	1.900	27	17.285	52	23.796	77	26.551
3	2.802	28	17.667	53	23.957	78	26.619
4	3.673	29	18.036	54	24.113	79	26.685
5	4.515	30	18.392	55	24.264	80	26.749
6	5.329	31	18.736	56	24.410	81	26.810
7	6.115	32	19.069	57	24.550	82	26.870
8	6.874	33	19.390	58	24.686	83	26.928
9	7.608	34	19.701	59	24.818	84	26.983
10	8.317	35	20.001	60	24.945	85	27.037
11	9.002	36	20.290	61	25.067	86	27.089
12	9.663	37	20.571	62	25.186	87	27.139
13	10.303	38	20.841	63	25.300	88	27.187
14	10.921	39	21.102	64	25.411	89	27.234
15	11.517	40	21.355	65	25.518	90	27.279
16	12.094	41	21.599	66	25.621	91	27.323
17	12.651	42	21.835	67	25.721	92	27.365
18	13.190	43	22.063	68	25.817	93	27.406
19	13.710	44	22.283	69	25.910	94	27.445
20	14.212	45	22.495	70	26.000	95	27.484
21	14.698	46	22.701	71	26.087	96	27.520
22	15.167	47	22.899	72	26.171	97	27.556
23	15.620	48	23.091	73	26.253	98	27.590
24	16.058	49	23.277	74	26.331	99	27.623
25	16.482	50	23.456	75	26.407	100	27.655

4 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs	Value.	Yrs.	Value.
1	.962	26	15.983	51	21.617	76	23.731
2	1.886	27	16.330	52	21.748	77	23.780
3	2.775	28	16.663	53	21.873	78	23.827
4	3.630	29	16.984	54	21.993	79	23.872
5	4.452	30	17.292	55	22.109	80	23.915
6	5.242	31	17.588	56	22.220	81	23.957
7	6.002	32	17.874	57	22.327	82	23.997
8	6.733	33	18.148	58	22.430	83	24.036
9	7.435	34	18.411	59	22.528	84	24.073
10	8.111	35	18.665	60	22.623	85	24.109
11	8.760	36	18.908	61	22.715	86	24.143
12	9.385	37	19.143	62	22.803	87	24.176
13	9.986	38	19.368	63	22.887	88	24.207
14	10.563	39	19.584	64	22.969	89	24.238
15	11.118	40	19.793	65	23.047	90	24.267
16	11.652	41	19.993	66	23.122	91	24.295
17	12.166	42	20.186	67	23.194	92	24.323
18	12.659	43	20.371	68	23.264	93	24.349
19	13.134	44	20.549	69	23.330	94	24.374
20	13.590	45	20.720	70	23.395	95	24.398
21	14.029	46	20.885	71	23.456	96	24.421
22	14.451	47	21.043	72	23.516	97	24.443
23	14.857	48	21.195	73	23.573	98	24.465
24	15.247	49	21.341	74	23.628	99	24.485
25	15.622	50	21.482	75	23.680	100	24.505

Table IV.—The Present Value of One Pound per Annum, &c.—*continued.*

4½ per Cent.								5 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.957	26	15.147	51	19.868	76	21.439	1	.952	26	14.375	51	18.339	76	19.509
2	1.873	27	15.451	52	19.969	77	21.473	2	1.859	27	14.643	52	18.418	77	19.533
3	2.749	28	15.743	53	20.066	78	21.505	3	2.723	28	14.898	53	18.493	78	19.555
4	3.588	29	16.022	54	20.159	79	21.536	4	3.546	29	15.141	54	18.565	79	19.576
5	4.390	30	16.289	55	20.248	80	21.565	5	4.329	30	15.372	55	18.633	80	19.596
6	5.158	31	16.544	56	20.333	81	21.594	6	5.076	31	15.593	56	18.699	81	19.616
7	5.893	32	16.789	57	20.414	82	21.621	7	5.786	32	15.803	57	18.761	82	19.634
8	6.596	33	17.023	58	20.492	83	21.647	8	6.463	33	16.003	58	18.820	83	19.651
9	7.269	34	17.247	59	20.567	84	21.671	9	7.108	34	16.193	59	18.876	84	19.668
10	7.913	35	17.461	60	20.638	85	21.695	10	7.722	35	16.374	60	18.929	85	19.684
11	8.529	36	17.666	61	20.706	86	21.718	11	8.306	36	16.547	61	18.980	86	19.699
12	9.119	37	17.862	62	20.772	87	21.740	12	8.863	37	16.711	62	19.029	87	19.713
13	9.683	38	18.050	63	20.834	88	21.760	13	9.394	38	16.868	63	19.075	88	19.727
14	10.223	39	18.230	64	20.894	89	21.780	14	9.899	39	17.017	64	19.119	89	19.740
15	10.740	40	18.402	65	20.951	90	21.799	15	10.380	40	17.159	65	19.161	90	19.752
16	11.234	41	18.566	66	21.006	91	21.817	16	10.838	41	17.294	66	19.201	91	19.764
17	11.707	42	18.724	67	21.058	92	21.835	17	11.274	42	17.423	67	19.239	92	19.775
18	12.160	43	18.874	68	21.108	93	21.852	18	11.690	43	17.546	68	19.275	93	19.786
19	12.593	44	19.018	69	21.156	94	21.868	19	12.085	44	17.663	69	19.310	94	19.796
20	13.208	45	19.156	70	21.202	95	21.883	20	12.462	45	17.774	70	19.343	95	19.806
21	13.405	46	19.288	71	21.246	96	21.897	21	12.821	46	17.880	71	19.374	96	19.815
22	13.784	47	19.415	72	21.288	97	21.911	22	13.163	47	17.981	72	19.404	97	19.824
23	14.148	48	19.536	73	21.328	98	21.925	23	13.489	48	18.077	73	19.432	98	19.832
24	14.495	49	19.651	74	21.367	99	21.938	24	13.799	49	18.169	74	19.459	99	19.840
25	14.828	50	19.762	75	21.404	100	21.950	25	14.094	50	18.256	75	19.485	100	19.848

Table IV.—The Present Value of One Pound per Annum, &c.—*continued.*

5½ per Cent.								6 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.948	26	13.663	51	16.997	76	17.871	1	.943	26	13.003	51	15.813	76	16.468
2	1.846	27	13.898	52	17.058	77	17.887	2	1.833	27	13.211	52	15.861	77	16.479
3	2.698	28	14.121	53	17.117	78	17.901	3	2.673	28	13.406	53	15.907	78	16.490
4	3.505	29	14.333	54	17.173	79	17.917	4	3.465	29	13.591	54	15.950	79	16.500
5	4.270	30	14.534	55	17.225	80	17.931	5	4.212	30	13.765	55	15.991	80	16.509
6	4.995	31	14.723	56	17.275	81	17.944	6	4.917	31	13.929	56	16.029	81	16.518
7	5.683	32	14.904	57	17.322	82	17.956	7	5.582	32	14.084	57	16.065	82	16.526
8	6.335	33	15.075	58	17.367	83	17.968	8	6.210	33	14.230	58	16.099	83	16.534
9	6.952	34	15.237	59	17.410	84	17.979	9	6.802	34	14.368	59	16.131	84	16.542
10	7.538	35	15.391	60	17.450	85	17.990	10	7.360	35	14.498	60	16.161	85	16.549
11	8.093	36	15.536	61	17.488	86	18.000	11	7.887	36	14.621	61	16.190	86	16.556
12	8.619	37	15.674	62	17.524	87	18.009	12	8.384	37	14.737	62	16.217	87	16.562
13	9.117	38	15.805	63	17.558	88	18.018	13	8.853	38	14.846	63	16.242	88	16.568
14	9.590	39	15.929	64	17.591	89	18.027	14	9.295	39	14.949	64	16.266	89	16.573
15	10.037	40	16.046	65	17.622	90	18.035	15	9.712	40	15.046	65	16.289	90	16.579
16	10.462	41	16.157	66	17.651	91	18.043	16	10.106	41	15.138	66	16.310	91	16.584
17	10.865	42	16.263	67	17.679	92	18.050	17	10.477	42	15.225	67	16.331	92	16.588
18	11.246	43	16.363	68	17.705	93	18.057	18	10.828	43	15.306	68	16.350	93	16.593
19	11.608	44	16.458	69	17.730	94	18.063	19	11.158	44	15.383	69	16.368	94	16.597
20	11.950	45	16.548	70	17.753	95	18.069	20	11.470	45	15.456	70	16.385	95	16.601
21	12.275	46	16.633	71	17.776	96	18.075	21	11.764	46	15.524	71	16.401	96	16.605
22	12.583	47	16.714	72	17.797	97	18.081	22	12.042	47	15.589	72	16.416	97	16.608
23	12.875	48	16.790	73	17.817	98	18.086	23	12.303	48	15.650	73	16.430	98	16.611
24	13.152	49	16.862	74	17.836	99	18.091	24	12.550	49	15.708	74	16.443	99	16.615
25	13.414	50	16.932	75	17.854	100	18.096	25	12.783	50	15.762	75	16.456	100	16.618

TABLE IV.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

7 per Cent.								8 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.935	26	11.826	51	13.832	76	14.202	1	.926	26	10.810	51	12.253	76	12.464
2	1.808	27	11.987	52	13.862	77	14.208	2	1.783	27	10.935	52	12.272	77	12.467
3	2.624	28	12.137	53	13.890	78	14.213	3	2.577	28	11.051	53	12.288	78	12.469
4	3.387	29	12.278	54	13.916	79	14.218	4	3.312	29	11.158	54	12.304	79	12.471
5	4.100	30	12.409	55	13.940	80	14.222	5	3.993	30	11.258	55	12.319	80	12.474
6	4.767	31	12.532	56	13.963	81	14.226	6	4.623	31	11.350	56	12.332	81	12.476
7	5.389	32	12.647	57	13.984	82	14.230	7	5.206	32	11.435	57	12.344	82	12.477
8	5.971	33	12.754	58	14.003	83	14.234	8	5.747	33	11.514	58	12.356	83	12.479
9	6.515	34	12.854	59	14.022	84	14.237	9	6.247	34	11.587	59	12.367	84	12.481
10	7.024	35	12.948	60	14.039	85	14.240	10	6.710	35	11.655	60	12.377	85	12.482
11	7.499	36	13.035	61	14.055	86	14.243	11	7.139	36	11.717	61	12.386	86	12.483
12	7.943	37	13.117	62	14.070	87	14.246	12	7.536	37	11.775	62	12.394	87	12.485
13	8.358	38	13.193	63	14.084	88	14.249	13	7.904	38	11.829	63	12.402	88	12.486
14	8.745	39	13.265	64	14.098	89	14.251	14	8.244	39	11.879	64	12.409	89	12.487
15	9.108	40	13.332	65	14.110	90	14.253	15	8.559	40	11.925	65	12.416	90	12.488
16	9.447	41	13.394	66	14.121	91	14.255	16	8.851	41	11.967	66	12.422	91	12.489
17	9.763	42	13.452	67	14.132	92	14.257	17	9.122	42	12.007	67	12.428	92	12.489
18	10.059	43	13.507	68	14.142	93	14.259	18	9.372	43	12.043	68	12.433	93	12.490
19	10.336	44	13.558	69	14.152	94	14.261	19	9.604	44	12.077	69	12.438	94	12.491
20	10.594	45	13.606	70	14.160	95	14.263	20	9.818	45	12.108	70	12.443	95	12.492
21	10.836	46	13.650	71	14.169	96	14.264	21	10.017	46	12.137	71	12.447	96	12.492
22	11.061	47	13.692	72	14.176	97	14.266	22	10.201	47	12.164	72	12.451	97	12.493
23	11.272	48	13.730	73	14.183	98	14.267	23	10.371	48	12.189	73	12.455	98	12.493
24	11.469	49	13.767	74	14.190	99	14.268	24	10.529	49	12.212	74	12.458	99	12.494
25	11.654	50	13.801	75	14.196	100	14.269	25	10.675	50	12.233	75	12.461	100	12.494

TABLE IV.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

9 per Cent.								10 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value
1	.917	26	9.929	51	10.974	76	11.095	1	.909	26	9.161	51	9.923	76	9.993
2	1.759	27	10.027	52	10.985	77	11.097	2	1.736	27	9.237	52	9.930	77	9.994
3	2.531	28	10.116	53	10.996	78	11.098	3	2.487	28	9.307	53	9.936	78	9.994
4	3.240	29	10.198	54	11.005	79	11.099	4	3.170	29	9.370	54	9.942	79	9.995
5	3.890	30	10.273	55	11.014	80	11.100	5	3.791	30	9.427	55	9.947	80	9.995
6	4.486	31	10.343	56	11.022	81	11.101	6	4.355	31	9.479	56	9.952	81	9.996
7	5.033	32	10.406	57	11.029	82	11.102	7	4.868	32	9.526	57	9.956	82	9.996
8	5.535	33	10.464	58	11.036	83	11.102	8	5.335	33	9.569	58	9.960	83	9.996
9	5.995	34	10.518	59	11.042	84	11.103	9	5.759	34	9.609	59	9.964	84	9.997
10	6.418	35	10.567	60	11.048	85	11.104	10	6.145	35	9.644	60	9.967	85	9.997
11	6.805	36	10.612	61	11.053	86	11.104	11	6.495	36	9.677	61	9.970	86	9.997
12	7.161	37	10.653	62	11.058	87	11.105	12	6.814	37	9.706	62	9.973	87	9.997
13	7.487	38	10.691	63	11.062	88	11.106	13	7.103	38	9.733	63	9.975	88	9.998
14	7.786	39	10.726	64	11.066	89	11.106	14	7.367	39	9.757	64	9.978	89	9.998
15	8.061	40	10.757	65	11.070	90	11.106	15	7.606	40	9.779	65	9.980	90	9.998
16	8.313	41	10.787	66	11.074	91	11.107	16	7.824	41	9.799	66	9.982	91	9.998
17	8.544	42	10.813	67	11.077	92	11.107	17	8.022	42	9.817	67	9.983	92	9.998
18	8.756	43	10.838	68	11.079	93	11.107	18	8.201	43	9.834	68	9.985	93	9.999
19	8.950	44	10.861	69	11.082	94	11.108	19	8.365	44	9.849	69	9.986	94	9.999
20	9.129	45	10.881	70	11.084	95	11.108	20	8.514	45	9.863	70	9.987	95	9.999
21	9.292	46	10.900	71	11.087	96	11.108	21	8.649	46	9.875	71	9.988	96	9.999
22	9.442	47	10.918	72	11.089	97	11.109	22	8.772	47	9.887	72	9.990	97	9.999
23	9.580	48	10.934	73	11.091	98	11.109	23	8.883	48	9.897	73	9.990	98	9.999
24	9.707	49	10.948	74	11.092	99	11.109	24	8.985	49	9.906	74	9.991	99	9.999
25	9.823	50	10.962	75	11.094	100	11.109	25	9.077	50	9.915	75	9.992	100	9.999

TABLE V.

THE PRESENT VALUE OF ONE POUND PER ANNUM PAYABLE FOR A TERM OF YEARS

As in Table IV., except that the Reserved Fund is supposed to be invested at the uniform rate of 3 per cent. interest.

Example.—An Estate held for 20 years is worth at the present time 11.4658 years' purchase if the purchaser expects 5 per cent. for his money, and intends to invest the Reserved Sum at 3 per cent.

Interest $3\frac{1}{2}$ per Cent.							
Years.	Value.	Years.	Value.	Years.	Value.	Years.	Value.
1	.9662	26	16.410	51	22.971	76	25.941
2	1.8953	27	16.786	52	23.139	77	26.019
3	2.7892	28	17.155	53	23.302	78	26.095
4	3.6493	29	17.509	54	23.460	79	26.168
5	4.4772	30	17.851	55	23.613	80	26.239
6	5.2743	31	18.182	56	23.762	81	26.307
7	6.0421	32	18.502	57	23.906	82	26.374
8	6.7817	33	18.813	58	24.045	83	26.439
9	7.4943	34	19.112	59	24.180	84	26.502
10	8.1812	35	19.403	60	24.311	85	26.563
11	8.8435	36	19.684	61	24.438	86	26.622
12	9.4821	37	19.955	62	24.562	87	26.679
13	10.0980	38	20.219	63	24.681	88	26.735
14	10.6922	39	20.473	64	24.797	89	26.789
15	11.2655	40	20.720	65	24.909	90	26.842
16	11.8188	41	20.959	66	25.018	91	26.893
17	12.3529	42	21.190	67	25.124	92	26.942
18	12.8685	43	21.414	68	25.226	93	26.990
19	13.3665	44	21.631	69	25.325	94	27.036
20	13.8474	45	21.841	70	25.422	95	27.081
21	14.3119	46	22.045	71	25.515	96	27.125
22	14.7608	47	22.242	72	25.606	97	27.168
23	15.1943	48	22.433	73	25.693	98	27.209
24	15.6135	49	22.618	74	25.778	99	27.250
25	16.0185	50	22.797	75	25.861	100	27.288

TABLE V.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

4 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9615	26	15.166	51	20.604	76	22.963
2	1.8775	27	15.488	52	20.739	77	23.024
3	2.7508	28	15.799	53	20.870	78	23.083
4	3.5839	29	16.099	54	20.997	79	23 140
5	4.3791	30	16.388	55	21.120	80	23.196
6	5.1388	31	16.667	56	21.238	81	23.249
7	5.8649	32	16 936	57	21.353	82	23.301
8	6.5593	33	17.195	58	21.465	83	23.352
9	7.2237	34	17.445	59	21.572	84	23.401
10	7.8597	35	17.686	60	21.676	85	23.448
11	8.4690	36	17.920	61	21.777	86	23.495
12	9.0528	37	18.145	62	21.875	87	23.539
13	9.6126	38	18.362	63	21.970	88	23.583
14	10.1496	39	18.572	64	22.062	89	23.625
15	10.6648	40	18.775	65	22.150	90	23.666
16	11.1594	41	18.971	66	22.237	91	23.705
17	11.6343	42	19.160	67	22.320	92	23.743
18	12.0906	43	19.343	68	22.401	93	23.781
19	12.5291	44	19.520	69	22.479	94	23.817
20	12.9507	45	19.691	70	22.555	95	23.852
21	13.3562	46	19.856	71	22.628	96	23.886
22	13.7462	47	20.016	72	22.699	97	23.919
23	14.1215	48	20.170	73	22.768	98	23.950
24	14.4828	49	20.320	74	22.835	99	23.981
25	14.8307	50	20.465	75	22.900	100	24.011

4½ per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs	Value.	Yrs.	Value
1	.9569	26	14.097	51	18.680	76	20.598
2	1.8601	27	14.375	52	18.787	77	20.647
3	2.7135	28	14.643	53	18.898	78	20.694
4	3.5208	29	14.900	54	19.002	79	20.740
5	4.2853	30	15.147	55	19.103	80	20.785
6	5.0101	31	15.385	56	19.200	81	20.828
7	5.6978	32	15.614	57	19.293	82	20.870
8	6.3510	33	15.834	58	19.384	83	20.911
9	6.9719	34	16.046	59	19.472	84	20.948
10	7.5626	35	16.250	60	19.557	85	20.988
11	8.1250	36	16.446	61	19.639	86	21.025
12	8.6609	37	16.636	62	19.719	87	21.061
13	9.1718	38	16 818	63	19.795	88	21.095
14	9.6594	39	16.994	64	19.870	89	21.129
15	10.1249	40	17.164	65	19.942	90	21.162
16	10.5696	41	17.327	66	20.012	91	21.193
17	10.9947	42	17.485	67	20.079	92	21.224
18	11.4038	43	17.637	68	20.144	93	21.254
19	11.7905	44	17.784	69	20.208	94	21.281
20	12.1631	45	17.925	70	20.269	95	21.310
21	12.5201	46	18.063	71	20.328	96	21.337
22	12.8622	47	18.195	72	20.386	97	21.364
23	13.1902	48	18.322	73	20.441	98	21.389
24	13.5049	49	18.446	74	20.495	99	21.414
25	13.8068	50	18.565	75	20.568	100	21.438

TABLE V.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

5 per Cent.								6 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs	Value.	Yrs,	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9524	26	13.169	51	17.084	76	18.675	1	.9434	26	11.636	51	14.591	76	15.736
2	1.8429	27	13.411	52	17.177	77	18.715	2	1.8096	27	11.826	52	14.659	77	15.765
3	2.6772	28	13.644	53	17.267	78	18.754	3	2.6074	28	12.006	53	14.724	78	15.792
4	3.4598	29	13.867	54	17.353	79	18.792	4	3.3442	29	12.178	54	14.787	79	15.819
5	4.1954	30	14.081	55	17.437	80	18.828	5	4.0265	30	12.343	55	14.848	80	15.845
6	4.8876	31	14.286	56	17.518	81	18.864	6	4.6699	31	12.500	56	14.907	81	15.870
7	5.5400	32	14.483	57	17.596	82	18.898	7	5.2492	32	12.651	57	14.963	82	15.894
8	6.1555	33	14.672	58	17.671	83	18.931	8	5.7986	33	12.795	58	15.018	83	15.918
9	6.7370	34	14.854	59	17.744	84	18.963	9	6.3118	34	12.933	59	15.070	84	15.941
10	7.2870	35	15.029	60	17.815	85	18.995	10	6.7920	35	13.065	60	15.121	85	15.962
11	7.8078	36	15.197	61	17.883	86	19.025	11	7.2423	36	13.192	61	15.170	86	15.984
12	8.3014	37	15.358	62	17.949	87	19.054	12	7.6651	37	13.314	62	15.218	87	16.005
13	8.7696	38	15.514	63	18.013	88	19.083	13	8.0626	38	13.430	63	15.263	88	16.025
14	9.2144	39	15.663	64	18.074	89	19.110	14	8.4370	39	13.542	64	15.308	89	16.044
15	9.6370	40	15.807	65	18.134	90	19.137	15	8.7899	40	13.650	65	15.350	90	16.063
16	10.0391	41	15.946	66	18.191	91	19.164	16	9.1232	41	13.753	66	15.391	91	16.081
17	10.4218	42	16.079	67	18.247	92	19.188	17	9.4381	42	13.852	67	15.431	92	16.099
18	10.7865	43	16.208	68	18.301	93	19.212	18	9.7362	43	13.947	68	15.470	93	16.116
19	11.1340	44	16.332	69	18.353	94	19.236	19	10.0187	44	14.039	69	15.507	94	16.132
20	11.4658	45	16.451	70	18.404	95	19.258	20	10.2864	45	14.127	70	15.543	95	16.148
21	11.7825	46	16.567	71	18.453	96	19.281	21	10.5405	46	14.212	71	15.578	96	16.164
22	12.0850	47	16.678	72	18.500	97	19.302	22	10.7820	47	14.294	72	15.612	97	16.179
23	12.3741	48	16.785	73	18.546	98	19.323	23	11.0115	48	14.372	73	15.644	98	16.194
24	12.6506	49	16.888	74	18.590	99	19.343	24	11.2300	49	14.448	74	15.676	99	16.208
25	12.9152	50	16.988	75	18.633	100	19.362	25	11.4380	50	14.521	75	15.706	100	16.222

TABLE V.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

7 per Cent.								8 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9346	26	10.423	51	12.733	76	13.596	1	.9259	26	9.439	51	11.295	76	11.969
2	1.7774	27	10.575	52	12 785	77	13.618	2	1.7464	27	9.564	52	11.336	77	11.986
3	2.5411	28	10.719	53	12.835	68	13.638	3	2.4781	28	9.681	53	11.375	78	12.002
4	3.2360	29	10.856	54	12.882	79	13.658	4	3.1345	29	9.793	54	11.412	79	12.017
5	3.8706	30	10.987	55	12.928	80	13.678	5	3.7264	30	9.899	55	11.448	80	12.032
6	4.4524	31	11.111	56	12.973	81	13.696	6	4.2626	31	10.000	56	11.483	81	12.046
7	4.9874	32	11.230	57	13.015	82	13.714	7	4.7505	32	10.096	57	11.517	82	12.060
8	5.4808	33	11.343	58	13.057	83	13.732	8	5.1960	33	10.188	58	11.549	83	12.074
9	5.9370	34	11.452	59	13.096	84	13.749	9	5.6043	34	10.275	59	11.580	84	12.087
10	6.3601	35	11.555	60	13.135	85	13.765	10	5.9798	35	10 358	60	11.610	85	12.100
11	6.7532	36	11.654	61	13.172	86	13.781	11	6.3260	36	10.438	61	11.639	86	12.112
12	7.1194	37	11.748	62	13.208	87	13.796	12	6.6462	37	10.514	62	11.667	87	12.124
13	7.4610	38	11.840	63	13.242	88	13.811	13	6.9430	38	10.587	63	11.694	88	12.135
14	7.7805	39	11.927	64	13.275	89	13.826	14	7.2189	39	10.656	64	11.720	89	12.146
15	8.0797	40	12.010	65	13.307	90	13.840	15	7.4757	40	10.722	65	11.745	90	12.157
16	8.3604	41	12.090	66	13.337	91	13.854	16	7.7154	41	10.786	66	11.769	91	12.168
17	8.6242	42	12.167	67	13.368	92	13.866	17	7.9395	42	10.847	67	11.792	92	12.178
18	8.8724	43	12.240	68	13.397	93	13.879	18	8.1494	43	10.905	68	11.815	93	12.188
19	9.1063	44	12.311	69	13.425	94	13.891	19	8.3463	44	10.961	69	11.836	94	12.197
20	9.3270	45	12.379	70	13.452	95	13 903	20	8.5313	45	11.015	70	11.857	95	12.206
21	9.5351	46	12.444	71	13.478	96	13.915	21	8.7053	46	11.067	71	11.878	96	12.215
22	9.7326	47	12.506	72	13.504	97	13.926	22	8.8694	47	11.116	72	11.897	97	12.224
23	9.9193	48	12.566	73	13.528	98	13.937	23	9.0241	48	11.163	73	11.916	98	12.232
24	10.0962	49	12.624	74	13.552	99	13.947	24	9.1703	49	11.209	74	11.934	99	12.240
25	10.2640	50	12.680	75	13.574	100	13.957	25	9.3086	50	11.253	75	11.952	100	12.248

TABLE V.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

9 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9174	26	8.625	51	10.149	76	10.690
2	1.7164	27	8.729	52	10.182	77	10.703
3	2.4182	28	8.827	53	10.213	78	10.716
4	3.0393	29	8.919	54	10.243	79	10.728
5	3.5925	30	9.007	55	10.272	80	10.740
6	4.0883	31	9.091	56	10.300	81	10.751
7	4.5350	32	9.170	57	10.327	82	10.762
8	4.9393	33	9.246	58	10.353	83	10.773
9	5.3069	34	9.318	59	10.378	84	10.784
10	5.6424	35	9.386	60	10.402	85	10.794
11	5.9497	36	9.451	61	10.425	86	10.804
12	6.2320	37	9.514	62	10.448	87	10.813
13	6.4922	38	9.573	63	10.469	88	10.822
14	6.7328	39	9.630	64	10.490	89	10.831
15	6.9557	40	9.684	65	10.510	90	10.839
16	7.1628	41	9.736	66	10.530	91	10.848
17	7.3555	42	9.786	67	10.548	92	10.856
18	7.5353	43	9.833	68	10.566	93	10.864
19	7.7033	44	9.878	69	10.584	94	10.871
20	7.8607	45	9.922	70	10.600	95	10.878
21	8.0082	46	9.964	71	10.617	96	10.885
22	8.1468	47	10.004	72	10.632	97	10.892
23	8.2772	48	10.042	73	10.647	98	10.899
24	8.4000	49	10.079	74	10.662	99	10.905
25	8.5158	50	10.115	75	10.676	100	10.911

10 per Cent.

Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9091	26	7.940	51	9.214	76	9.657
2	1.6874	27	8.028	52	9.241	77	9.668
3	2.3611	28	8.111	53	9.267	78	9.678
4	2.9496	29	8.189	54	9.291	79	9.689
5	3.4680	30	8.263	55	9.315	80	9.698
6	3.9279	31	8.333	56	9.338	81	9.708
7	4.3383	32	8.400	57	9.361	82	9.717
8	4.7069	33	8.463	58	9.382	83	9.725
9	5.0395	34	8.524	59	9.402	84	9.734
10	5.3410	35	8.581	60	9.422	85	9.742
11	5.6156	36	8.635	61	9.441	86	9.750
12	5.8664	37	8.687	62	9.459	87	9.758
13	6.0965	38	8.737	63	9.477	88	9.765
14	6.3082	39	8.784	64	9.494	89	9.773
15	6.5034	40	8.829	65	9.511	90	9.779
16	6.6840	41	8.872	66	9.526	91	9.786
17	6.8515	42	8.913	67	9.542	92	9.793
18	7.0073	43	8.953	68	9.556	93	9.799
19	7.1524	44	8.990	69	9.571	94	9.805
20	7.2878	45	9.026	70	9.584	95	9.811
21	7.4144	46	9.061	71	9.598	96	9.817
22	7.5331	47	9.094	72	9.610	97	9.822
23	7.6444	48	9.126	73	9.623	98	9.828
24	7.7491	49	9.156	74	9.635	99	9.833
25	7.8476	50	9.186	75	9.646	100	9.838

Table VI.

The Present Value of the Reversion of One Pound at the End of any Number of Years.

Example.—A Legacy of £100 to be paid in 20 years hence is worth at the present time at 5 per cent. only £37.69.

Interest 2 per Cent.							
Years.	Value.	Years.	Value.	Years.	Value	Years.	Value.
1	.9804	26	.5976	51	.3642	76	.2220
2	.9612	27	.5859	52	.3571	77	.2177
3	.9423	28	.5744	53	.3501	78	.2134
4	.9239	29	.5631	54	.3432	79	.2092
5	.9057	30	.5521	55	.3365	80	.2051
6	.8880	31	.5412	56	.3299	81	.2011
7	.8706	32	.5306	57	.3234	82	.1971
8	.8535	33	.5202	58	.3171	83	.1933
9	.8368	34	.5100	59	.3109	84	.1895
10	.8203	35	.5000	60	.3048	85	.1858
11	.8043	36	.4902	61	.2988	86	.1821
12	.7885	37	.4806	62	.2930	87	.1786
13	.7730	38	.4712	63	.2872	88	.1751
14	.7579	39	.4620	64	.2816	89	.1716
15	.7430	40	.4529	65	.2761	90	.1683
16	.7285	41	.4440	66	.2706	91	.1650
17	.7142	42	.4353	67	.2653	92	.1617
18	.7002	43	.4268	68	.2601	93	.1586
19	.6864	44	.4184	69	.2550	94	.1554
20	.6730	45	.4102	70	.2500	95	.1524
21	.6598	46	.4022	71	.2451	96	.1494
22	.6468	47	.3943	72	.2403	97	.1465
23	.6342	48	.3865	73	.2356	98	.1436
24	.6217	49	.3790	74	.2310	99	.1408
25	.6095	50	.3715	75	.2265	100	.1380

TABLE VI.—THE PRESENT VALUE OF THE REVERSION OF ONE POUND, &c.—*continued.*

2½ per Cent.								3 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value
1	.9756	26	.5262	51	.2838	76	.1531	1	.9709	26	.4637	51	.2215	76	.1058
2	.9518	27	.5134	52	.2769	77	.1494	2	.9430	27	.4502	52	.2150	77	.1027
3	.9286	28	.5009	53	.2702	78	.1457	3	.9151	28	.4371	53	.2088	78	.0997
4	.9060	29	.4887	54	.2636	79	.1422	4	.8885	29	.4243	54	.2027	79	.0968
5	.8839	30	.4767	55	.2572	80	.1387	5	.8626	30	.4120	55	.1968	80	.0940
6	.8623	31	.4651	56	.2509	81	.1353	6	.8375	31	.4000	56	.1910	81	.0912
7	.8413	32	.4538	57	.2448	82	.1320	7	.8131	32	.3883	57	.1855	82	.0886
8	.8207	33	.4427	58	.2388	83	.1288	8	.7894	33	.3770	58	.1801	83	.0860
9	.8007	34	.4319	59	.2330	84	.1257	9	.7664	34	.3660	59	.1748	84	.0835
10	.7812	35	.4214	60	.2273	85	.1226	10	.7441	35	.3554	60	.1697	85	.0811
11	.7621	36	.4111	61	.2217	86	.1196	11	.7224	36	.3450	61	.1648	86	.0787
12	.7436	37	.4011	62	.2163	87	.1167	12	.7014	37	.3350	62	.1600	87	.0764
13	.7254	38	.3913	63	.2111	88	.1138	13	.6810	38	.3252	63	.1553	88	.0742
14	.7077	39	.3817	64	.2059	89	.1111	14	.6611	39	.3158	64	.1508	89	.0720
15	.6905	40	.3724	65	.2009	90	.1084	15	.6419	40	.3066	65	.1464	90	.0699
16	.6736	41	.3634	66	.1960	91	.1057	16	.6232	41	.2976	66	.1421	91	.0679
17	.6572	42	.3545	67	.1912	92	.1031	17	.6050	42	.2890	67	.1380	92	.0659
18	.6412	43	.3458	68	.1865	93	.1006	18	.5874	43	.2805	68	.1340	93	.0640
19	.6255	44	.3374	69	.1820	94	.0982	19	.5703	44	.2724	69	.1301	94	.0621
20	.6103	45	.3292	70	.1776	95	.0958	20	.5537	45	.2644	70	.1263	95	.0603
21	.5954	46	.3211	71	.1732	96	.0934	21	.5375	46	.2567	71	.1226	96	.0586
22	.5809	47	.3133	72	.1690	97	.0912	22	.5219	47	.2493	72	.1190	97	.0569
23	.5667	48	.3057	73	.1649	98	.0889	23	.5067	48	.2420	73	.1156	98	.0552
24	.5529	49	.2982	74	.1609	99	.0868	24	.4919	49	.2350	74	.1122	99	.0536
25	.5394	50	.2909	75	.1569	100	.0846	25	.4776	50	.2281	75	.1089	100	.0520

TABLE VI.—THE PRESENT VALUE OF THE REVERSION OF ONE POUND, &c.—*continued.*

$3\frac{1}{2}$ per Cent.								4 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9662	26	.4088	51	.1730	76	.0732	1	.9615	26	.3607	51	.1353	76	.0508
2	.9335	27	.3950	52	.1671	77	.0707	2	.9246	27	.3468	52	.1301	77	.0488
3	.9019	28	.3817	53	.1615	78	.0683	3	.8890	28	.3335	53	.1251	78	.0469
4	.8714	29	.3687	54	.1560	79	.0660	4	.8548	29	.3207	54	.1203	79	.0451
5	.8420	30	.3563	55	.1508	80	.0638	5	.8219	30	.3083	55	.1157	80	.0434
6	.8135	31	.3442	56	.1457	81	.0616	6	.7903	31	.2965	56	.1112	81	.0417
7	.7860	32	.3326	57	.1407	82	.0596	7	.7599	32	.2851	57	.1069	82	.0401
8	.7594	33	.3213	58	.1360	83	.0575	8	.7307	33	.2741	58	.1028	83	.0386
9	.7337	34	.3105	59	.1314	84	.0556	9	.7026	34	.2636	59	.0989	84	.0371
10	.7089	35	.3000	60	.1269	85	.0537	10	.6756	35	.2534	60	.0951	85	.0357
11	.6849	36	.2898	61	.1226	86	.0519	11	.6496	36	.2437	61	.0914	86	.0343
12	.6618	37	.2800	62	.1185	87	.0501	12	.6246	37	.2343	62	.0879	87	.0330
13	.6394	38	.2706	63	.1145	88	.0484	13	.6006	38	.2253	63	.0845	88	.0317
14	.6178	39	.2614	64	.1106	89	.0468	14	.5775	39	.2166	64	.0813	89	.0305
15	.5969	40	.2526	65	.1069	90	.0452	15	.5553	40	.2083	65	.0781	90	.0293
16	.5767	41	.2440	66	.1033	91	.0437	16	.5339	41	.2003	66	.0751	91	.0282
17	.5572	42	.2358	67	.0998	92	.0422	17	.5134	42	.1926	67	.0722	92	.0271
18	.5384	43	.2278	68	.0964	93	.0408	18	.4936	43	.1852	68	.0695	93	.0261
19	.5202	44	.2201	69	.0931	94	.0394	19	.4746	44	.1780	69	.0668	94	.0251
20	.5026	45	.2127	70	.0900	95	.0381	20	.4564	45	.1712	70	.0642	95	.0241
21	.4856	46	.2055	71	.0869	96	.0368	21	.4388	46	.1646	71	.0617	96	.0232
22	.4692	47	.1985	72	.0840	97	.0355	22	.4220	47	.1583	72	.0594	97	.0223
23	.4533	48	.1918	73	.0812	98	.0343	23	.4057	48	.1522	73	.0571	98	.0214
24	.4380	49	.1853	74	.0784	99	.0332	24	.3901	49	.1463	74	.0549	99	.0206
25	.4232	50	.1791	75	.0758	100	.0321	25	.3751	50	.1407	75	.0528	100	.0198

TABLE VI.—THE PRESENT VALUE OF THE REVERSION OF ONE POUND, &c.—*continued.*

4½ per Cent.								5 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9569	26	.3184	51	.1059	76	.0353	1	.9524	26	.2812	51	.0831	76	.0245
2	.9157	27	.3047	52	.1014	77	.0337	2	.9070	27	.2678	52	.0791	77	.0234
3	.8763	28	.2916	53	.0970	78	.0323	3	.8638	28	.2551	53	.0753	78	.0222
4	.8386	29	.2790	54	.0928	79	.0309	4	.8227	29	.2429	54	.0717	79	.0212
5	.8025	30	.2670	55	.0888	80	.0296	5	.7835	30	.2314	55	.0683	80	.0202
6	.7679	31	.2555	56	.0850	81	.0283	6	.7462	31	.2204	56	.0651	81	.0192
7	.7348	32	.2445	57	.0814	82	.0271	7	.7107	32	.2099	57	.0620	82	.0183
8	.7032	33	.2340	58	.0779	83	.0259	8	.6768	33	.1999	58	.0590	83	.0174
9	.6729	34	.2239	59	.0745	84	.0248	9	.6446	34	.1904	59	.0562	84	.0166
10	.6439	35	.2143	60	.0713	85	.0237	10	.6139	35	.1813	60	.0535	85	.0158
11	.6162	36	.2050	61	.0682	86	.0227	11	.5847	36	.1727	61	.0510	86	.0151
12	.5897	37	.1962	62	.0653	87	.0217	12	.5568	37	.1644	62	.0486	87	.0143
13	.5643	38	.1878	63	.0625	88	.0208	13	.5303	38	.1566	63	.0462	88	.0137
14	.5400	39	.1797	64	.0598	89	.0199	14	.5051	39	.1491	64	.0440	89	.0130
15	.5167	40	.1719	65	.0572	90	.0190	15	.4810	40	.1420	65	.0419	90	.0124
16	.4945	41	.1645	66	.0547	91	.0182	16	.4581	41	.1353	66	.0399	91	.0118
17	.4732	42	.1574	67	.0524	92	.0174	17	.4363	42	.1288	67	.0380	92	.0112
18	.4528	43	.1507	68	.0501	93	.0167	18	.4155	43	.1227	68	.0362	93	.0107
19	.4333	44	.1442	69	.0480	94	.0160	19	.3957	44	.1169	69	.0345	94	.0102
20	.4146	45	.1380	70	.0459	95	.0153	20	.3769	45	.1113	70	.0329	95	.0097
21	.3968	46	.1320	71	.0439	96	.0146	21	.3589	46	.1060	71	.0313	96	.0092
22	.3797	47	.1263	72	.0420	97	.0140	22	.3418	47	.1009	72	.0298	97	.0088
23	.3634	48	.1209	73	.0402	98	.0134	23	.3256	48	.0961	73	.0284	98	.0084
24	.3477	49	.1157	74	.0385	99	.0128	24	.3101	49	.0916	74	.0270	99	.0080
25	.3327	50	.1107	75	.0368	100	.0123	25	.2953	50	.0872	75	.0258	100	.0076

TABLE VI.—THE PRESENT VALUE OF THE REVERSION OF ONE POUND, &c.—*continued.*

6 per Cent.								7 per Cent.							
Yrs.	Value.	Yrs.	Value	Yrs.	Value.	Yrs.	Value.	Yrs.	Value	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9434	26	.2198	51	.0512	76	.0119	1	.9346	26	.1722	51	.0317	76	.0058
2	.8900	27	.2074	52	.0483	77	.0113	2	.8734	27	.1609	52	.0297	77	.0055
3	.8396	28	.1956	53	.0456	78	.0106	3	.8163	28	.1504	53	.0277	78	.0051
4	.7921	29	.1846	54	.0430	79	.0100	4	.7629	29	.1406	54	.0259	79	.0048
5	.7473	30	.1741	55	.0406	80	.0095	5	.7130	30	.1314	55	.0242	80	.0045
6	.7050	31	.1643	56	.0383	81	.0089	6	.6663	31	.1228	56	.0226	81	.0042
7	.6651	32	.1550	57	.0361	82	.0084	7	.6227	32	.1147	57	.0211	82	.0039
8	.6274	33	.1462	58	.0341	83	.0079	8	.5820	33	.1072	58	.0198	83	.0036
9	.5919	34	.1379	59	.0321	84	.0075	9	.5439	34	.1002	59	.0185	84	.0034
10	.5584	35	.1301	60	.0303	85	.0071	10	.5084	35	.0937	60	.0173	85	.0032
11	.5268	36	.1227	61	.0286	86	.0067	11	.4751	36	.0875	61	.0161	86	.0030
12	.4970	37	.1158	62	.0270	87	.0063	12	.4440	37	.0818	62	.0151	87	.0028
13	.4688	38	.1092	63	.0255	88	.0059	13	.4150	38	.0765	63	.0141	88	.0026
14	.4423	39	.1031	64	.0240	89	.0056	14	.3878	39	.0715	64	.0132	89	.0024
15	.4173	40	.0972	65	.0227	90	.0053	15	.3624	40	.0668	65	.0123	90	.0023
16	.3936	41	.0917	66	.0214	91	.0050	16	.3387	41	.0624	66	.0115	91	.0021
17	.3714	42	.0865	67	.0202	92	.0047	17	.3166	42	.0583	67	.0107	92	.0020
18	.3503	43	.0816	68	.0190	93	.0044	18	.2959	43	.0545	68	.0100	93	.0019
19	.3305	44	.0770	69	.0179	94	.0042	19	.2765	44	.0509	69	.0094	94	.0017
20	.3118	45	.0727	70	.0169	95	.0039	20	.2584	45	.0476	70	.0088	95	.0016
21	.2942	46	.0685	71	.0160	96	.0037	21	.2415	46	.0445	71	.0082	96	.0015
22	.2775	47	.0647	72	.0151	97	.0035	22	.2257	47	.0416	72	.0077	97	.0014
23	.2618	48	.0610	73	.0142	98	.0033	23	.2109	48	.0389	73	.0072	98	.0013
24	.2470	49	.0575	74	.0134	99	.0031	24	.1971	49	.0363	74	.0067	99	.0012
25	.2330	50	.0543	75	.0127	100	.0030	25	.1842	50	.0339	75	.0063	100	.0012

Table VI.—The Present Value of the Reversion of One Pound, &c.—*continued.*

8 per Cent.								9 per Cent.							
Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.	Yrs.	Value.
1	.9259	26	.1352	51	.0197	76	.0029	1	.9174	26	.1064	51	.0123	76	.0014
2	.8573	27	.1252	52	.0183	77	.0027	2	.8417	27	.0976	52	.0113	77	.0013
3	.7938	28	.1159	53	.0169	78	.0025	3	.7722	28	.0896	53	.0104	78	.0012
4	.7350	29	.1073	54	.0157	79	.0023	4	.7084	29	.0822	54	.0095	79	.0011
5	.6806	30	.0994	55	.0145	80	.0021	5	.6499	30	.0754	55	.0087	80	.0010
6	.6302	31	.0920	56	.0134	81	.0020	6	.5963	31	.0691	56	.0080	81	.0009
7	.5835	32	.0852	57	.0124	82	.0018	7	.5470	32	.0634	57	.0074	82	.0009
8	.5403	33	.0789	58	.0115	83	.0017	8	.5019	33	.0582	58	.0067	83	.0008
9	.5002	34	.0730	59	.0107	84	.0016	9	.4604	34	.0534	59	.0062	84	.0007
10	.4632	35	.0676	60	.0099	85	.0014	10	.4224	35	.0490	60	.0057	85	.0007
11	.4289	36	.0626	61	.0091	86	.0013	11	.3875	36	.0449	61	.0052	86	.0006
12	.3971	37	.0580	62	.0085	87	.0012	12	.3555	37	.0412	62	.0048	87	.0006
13	.3677	38	.0537	63	.0078	88	.0011	13	.3262	38	.0378	63	.0044	88	.0005
14	.3405	39	.0497	64	.0073	89	.0011	14	.2992	39	.0347	64	.0040	89	.0005
15	.3152	40	.0460	65	.0067	90	.0010	15	.2745	40	.0318	65	.0037	90	.0004
16	.2919	41	.0426	66	.0062	91	.0009	16	.2519	41	.0292	66	.0034	91	.0004
17	.2703	42	.0395	67	.0058	92	.0008	17	.2311	42	.0268	67	.0031	92	.0004
18	.2502	43	.0365	68	.0053	93	.0008	18	.2120	43	.0246	68	.0029	93	.0003
19	.2317	44	.0338	69	.0049	94	.0007	19	.1945	44	.0226	69	.0026	94	.0003
20	.2145	45	.0313	70	.0046	95	.0007	20	.1784	45	.0207	70	.0024	95	.0003
21	.1987	46	.0290	71	.0042	96	.0006	21	.1637	46	.0190	71	.0022	96	.0003
22	.1839	47	.0269	72	.0039	97	.0006	22	.1502	47	.0174	72	.0020	97	.0002
23	.1703	48	.0249	73	.0036	98	.0005	23	.1378	48	.0160	73	.0019	98	.0002
24	.1577	49	.0230	74	.0034	99	.0005	24	.1264	49	.0147	74	.0017	99	.0002
25	.1460	50	.0213	75	.0031	100	.0005	25	.1160	50	.0135	75	.0016	100	.0002

Table VI.

The Present Value of the Reversion of One Pound, &c.—*continued.*

10 per Cent.							
Years.	Value.	Years.	Value.	Years.	Value.	Years.	Value.
1	.9091	26	.0839	51	.0077	76	.0007
2	.8264	27	.0763	52	.0070	77	.0007
3	.7513	28	.0693	53	.0064	78	.0006
4	.6830	29	.0630	54	.0058	79	.0005
5	.6209	30	.0573	55	.0053	80	.0005
6	.5645	31	.0521	56	.0048	81	.0004
7	.5132	32	.0474	57	.0044	82	.0004
8	.4665	33	.0431	58	.0040	83	.0004
9	.4241	34	.0391	59	.0036	84	.0003
10	.3855	35	.0356	60	.0033	85	.0003
11	.3505	36	.0324	61	.0030	86	.0003
12	.3186	37	.0294	62	.0027	87	.0003
13	.2897	38	.0267	63	.0025	88	.0002
14	.2633	39	.0243	64	.0022	89	.0002
15	.2394	40	.0221	65	.0020	90	.0002
16	.2176	41	.0201	66	.0019	91	.0002
17	.1978	42	.0183	67	.0017	92	.0002
18	.1799	43	.0166	68	.0015	93	.0001
19	.1635	44	.0151	69	.0014	94	.0001
20	.1486	45	.0137	70	.0013	95	.0001
21	.1351	46	.0125	71	.0012	96	.0001
22	.1228	47	.0113	72	.0010	97	.0001
23	.1117	48	.0103	73	.0010	98	.0001
24	.1015	49	.0094	74	.0009	99	.0001
25	.0923	50	.0085	75	.0008	100	.0001

TABLE VII.

THE PRESENT VALUE OF ONE POUND PER ANNUM HELD ON A SINGLE LIFE, ACCORDING TO THE CARLISLE TABLE OF MORTALITY.

Example:—An Estate, Lease, or Annuity, held during the Life of a Person aged 30, is worth at the present time 14.72 years' purchase, if the purchaser expects 5 per Cent. for his money, and can Invest the Reserved Sum at the same rate.

Interest 3 per Cent.							
Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.
Birth	17.32	26	20.44	52	13.56	78	4.84
1	20.08	27	20.21	53	13.18	79	4.59
2	21.50	28	19.98	54	12.80	80	4.36
3	22.68	29	19.76	55	12.41	81	4.12
4	23.28	30	19.56	56	12.01	82	3.90
5	23.69	31	19.35	57	11.61	83	3.67
6	23.85	32	19.14	58	11.22	84	3.45
7	23.87	33	18.91	59	10.84	85	3.23
8	23.80	34	18.68	60	10.49	86	3.03
9	23.68	35	18.43	61	10.18	87	2.87
10	23.51	36	18.18	62	9.88	88	2.78
11	23.33	37	17.93	63	9.57	89	2.66
12	23.14	38	17.67	64	9.25	90	2.50
13	22.96	39	17.40	65	8.92	91	2.48
14	22.77	40	17.14	66	8.58	92	2.58
15	22.58	41	16.89	67	8.23	93	2.69
16	22.40	42	16.64	68	7.87	94	2.74
17	22.23	43	16.39	69	7.50	95	2.76
18	22.06	44	16.13	70	7.12	96	2.70
19	21.88	45	15.86	71	6.74	97	2.56
20	21.70	46	15.58	72	6.37	98	2.39
21	21.51	47	15.29	73	6.04	99	2.13
22	21.31	48	14.99	74	5.75	100	1.68
23	21.10	49	14.65	75	5.51	101	1.23
24	20.89	50	14.30	76	5.28	102	.77
25	20.67	51	13.93	77	5.06	103	.32

TABLE VII.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

3½ per Cent.								4 per Cent.							
Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value	Age.	Value.
Birth	15.67	26	18.87	52	12.88	78	4.73	Birth	14.28	26	17.49	52	12.26	78	4.62
1	18.17	27	18.67	53	12.54	79	4.49	1	16.55	27	17.32	53	11.95	79	4.39
2	19.46	28	18.48	54	12.19	80	4.27	2	17.73	28	17.15	54	11.63	80	4.18
3	20.53	29	18.29	55	11.83	81	4.03	3	18.72	29	17.00	55	11.30	81	3.95
4	21.09	30	18.12	56	11.47	82	3.82	4	19.23	30	16.85	56	10.97	82	3.75
5	21.48	31	17.95	57	11.10	83	3.60	5	19.59	31	16.71	57	10.63	83	3.53
6	21.63	32	17.77	58	10.74	84	3.39	6	19.75	32	16.55	58	10.29	84	3.33
7	21.67	33	17.58	59	10.39	85	3.17	7	19.79	33	16.39	59	9.96	85	3.12
8	21.62	34	17.38	60	10.06	86	2.98	8	19.76	34	16.22	60	9.66	86	2.93
9	21.53	35	17.17	61	9.78	87	2.82	9	19.69	35	16.04	61	9.40	87	2.78
10	21.39	36	16.95	62	9.49	88	2.73	10	19.58	36	15.86	62	9.14	88	2.68
11	21.24	37	16.73	63	9.21	89	2.62	11	19.46	37	15.67	63	8.87	89	2.58
12	21.09	38	16.51	64	8.91	90	2.46	12	19.33	38	15.47	64	8.59	90	2 42
13	20.94	39	16.28	65	8.60	91	2.44	13	19.21	39	15.27	65	8.31	91	2.40
14	20.79	40	16.05	66	8.29	92	2.53	14	19.08	40	15.07	66	8.01	92	2.49
15	20.63	41	15.83	67	7.96	93	2.64	15	18.96	41	14.88	67	7.70	93	2.60
16	20.49	42	15.62	68	7.62	94	2.69	16	18.84	42	14.69	68	7.38	94	2.65
17	20.35	43	15.40	69	7.27	95	2.72	17	18.72	43	14.51	69	7.05	95	2.67
18	20.21	44	15.17	70	6.91	96	2.67	18	18.61	44	14.31	70	6.71	96	2.63
19	20.06	45	14.94	71	6.54	97	2.53	19	18.49	45	14.10	71	6.36	97	2.49
20	19.91	46	14.70	72	6.19	98	2.36	20	18.36	46	13.89	72	6.03	98	2.33
21	19.76	47	14.44	73	5.88	99	2.11	21	18.23	47	13.66	73	5.72	99	2.09
22	19.59	48	14.17	74	5.60	100	1.67	22	18.09	48	13.42	74	5.46	100	1.65
23	19.42	49	13.87	76	5.37	101	1.22	23	17.95	49	13.15	75	5.24	101	1.21
24	19.24	50	13.55	76	5.15	102	.77	24	17.80	50	12.87	76	5.02	102	.76
25	19.06	51	13.22	77	4.94	103	.32	25	17.64	51	12.57	77	4.82	103	.32

TABLE VII.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

5 per Cent.								6 per Cent.							
Age.	Value.	Age.	Value.	Age.	Value	Age.	Value	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.
Birth	12.08	26	15.19	52	11.15	78	4.42	Birth	10.44	26	13.37	52	10.21	78	4.24
1	13.99	27	15.07	53	10.89	79	4.21	1	12.08	27	13.28	53	9.99	79	4.04
2	14.98	28	14.94	54	10.62	80	4.01	2	12.93	28	13.18	54	9.76	80	3.86
3	15.82	29	14.83	55	10 35	81	3.80	3	13.65	29	13.10	55	9.52	81	3.66
4	16.27	30	14.72	56	10.06	82	3.61	4	14.04	30	13.02	56	9.28	82	3.47
5	16.59	31	14.62	57	9.77	83	3.41	5	14.33	31	12.94	57	9.03	83	3.29
6	16.73	32	14.51	58	9.48	84	3.21	6	14.46	32	12.86	58	8.77	84	3.10
7	16.79	33	14.39	59	9.20	85	3.01	7	14.52	33	12.77	59	8.53	85	2.91
8	16.79	34	14.26	60	8.94	86	2.83	8	14.53	34	12.67	60	8.30	86	2.74
9	16.74	35	14.13	61	8.71	87	2.68	9	14.50	35	12.57	61	8.11	87	2.60
10	16.67	36	13 99	62	8.49	88	2.60	10	14.45	36	12.47	62	7.91	88	2.52
11	16.58	37	13.84	63	8.26	89	2.49	11	14.38	37	12.35	63	7.71	89	2.42
12	16.49	38	13.69	64	8.02	90	2.34	12	14.32	38	12.24	64	7.50	90	2.27
13	16.41	39	13.54	65	7.77	91	2.32	13	14.26	39	12.12	65	7.28	91	2.25
14	16.32	40	13.39	66	7.50	92	2.41	14	14.19	40	12.00	66	7.05	92	2.34
15	16.23	41	13.24	67	7.23	93	2.52	15	14.13	41	11.89	67	6.80	93	2.44
16	16.15	42	13.10	68	6.94	94	2.57	16	14.07	42	11.78	68	6.55	94	2.49
17	16.07	43	12.96	69	6.64	95	2.60	17	14.01	43	11.67	69	6.28	95	2.52
18	15.99	44	12.81	70	6.34	96	2.56	18	13.96	44	11.55	70	6 00	96	2.49
19	15.90	45	12.65	71	6.01	97	2.43	19	13.90	45	11.43	71	5.70	97	2.37
20	15.82	46	12.48	72	5.71	98	2.28	20	13.83	46	11.30	72	5.42	98	2.23
21	15.73	47	12.30	73	5.43	99	2.04	21	13.77	47	11.15	73	5.17	99	2.00
22	15.63	48	12.11	74	5.19	100	1.62	22	13.70	48	11.00	74	4.94	100	1.60
23	15.53	49	11.89	75	4.99	101	1.19	23	13.62	49	10.82	75	4.76	101	1.18
24	15.42	50	11.66	76	4.79	102	.75	24	13.54	50	10.63	76	4.58	102	.74
25	15.30	51	11.41	77	4.61	103	.32	25	13.46	51	10.42	77	4.41	103	.31

TABLE VII.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

7 per Cent.							
Age.	Value	Age.	Value.	Age.	Value.	Age.	Value
Birth	9.18	26	11.90	52	9.39	78	4.07
1	10.61	27	11.83	53	9.21	79	3.88
2	11.34	28	11.76	54	9.01	80	3.71
3	11.98	29	11.69	55	8.81	81	3.52
4	12.32	30	11.64	56	8.60	82	3.35
5	12.57	31	11.58	57	8.38	83	3.17
6	12.70	32	11.52	58	8.15	84	3.00
7	12.76	33	11.45	59	7.94	85	2.82
8	12 77	34	11.37	60	7.74	86	2.65
9	12.75	35	11.30	61	7.57	87	2.52
10	12.72	36	11.21	62	7.40	88	2.44
11	12.67	37	11.12	63	7.23	89	2.34
12	12.62	38	11.03	64	7.04	90	2.20
13	12.57	39	10.94	65	6.85	91	2.18
14	12.52	40	10.85	66	6.64	92	2.27
15	12.47	41	10.76	67	6.42	93	2.37
16	12.43	42	10.67	68	6.19	94	2.42
17	12.39	43	10.59	69	5.95	95	2.45
18	12.35	44	10.49	70	5.69	96	2.42
19	12.31	45	10.40	71	5.42	97	2.31
20	12.26	46	10.29	72	5.16	98	2.18
21	12.21	47	10.18	73	4.93	99	1.96
22	12.16	48	10.05	74	4.72	100	1.57
23	12.10	49	9.91	75	4.55	101	1.16
24	12.04	50	9.75	76	4.38	102	.74
25	11.97	51	9.57	77	4.23	103	.31

8 per Cent.							
Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.
Birth	8.18	26	10.71	52	8.68	78	3.91
1	9.44	27	10.65	53	8.52	79	3.74
2	10.09	28	10.59	54	8.36	80	3.58
3	10.65	29	10.54	55	8.18	81	3.40
4	10.96	30	10.50	56	7.99	82	3.24
5	11.19	31	10.45	57	7.80	83	3.07
6	11.30	32	10.41	58	7.61	84	2.90
7	11.36	33	10.35	59	7.42	85	2.73
8	11.37	34	10.31	60	7.24	86	2.57
9	11.36	35	10.23	61	7.10	87	2.44
10	11.33	36	10.17	62	6.95	88	2.37
11	11.30	37	10.10	63	6.79	89	2.28
12	11.26	38	10.02	64	6.63	90	2.13
13	11.22	39	9.95	65	6.46	91	2.12
14	11.18	40	9.87	66	6.27	92	2.20
15	11.15	41	9.80	67	6.07	93	2.30
16	11.11	42	9.74	68	5.87	94	2.35
17	11.08	43	9.67	69	5.64	95	2.38
18	11.05	44	9.60	70	5.41	96	2.36
19	11.02	45	9.52	71	5.16	97	2.25
20	10.98	46	9.44	72	4.92	98	2.13
21	10.95	47	9.34	73	4.70	99	1.93
22	10.91	48	9.24	74	4.51	100	1.54
23	10.86	49	9.12	75	4.35	101	1.14
24	10.81	50	8.99	76	4.20	102	.73
25	10.76	51	8.84	77	4.06	103	.31

Table VII.—The Present Value of One Pound per Annum, &c.—*continued.*

9 per Cent.								10 per Cent.							
Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.
Birth	7.37	26	9.72	52	8.06	78	3.76	Birth	6.72	26	8.89	52	7.52	78	3.62
1	8.50	27	9.67	53	7.92	79	3.60	1	7.73	27	8.85	53	7.40	79	3.47
2	9.08	28	9.62	54	7.78	80	3.45	2	8.25	28	8.81	54	7.27	80	3.33
3	9.58	29	9.58	55	7.63	81	3.28	3	8.71	29	8.77	55	7.14	81	3.17
4	9.86	30	9.55	56	7.46	82	3.13	4	8.95	30	8.75	56	6.99	82	3.03
5	10.06	31	9.51	57	7.29	83	2.97	5	9.14	31	8.72	57	6.84	83	2.88
6	10.17	32	9.47	58	7.12	84	2.81	6	9.24	32	8.69	58	6.69	84	2.73
7	10.22	33	9.43	59	6.95	85	2.64	7	9.29	33	8.66	59	6.54	85	2.57
8	10.24	24	9.39	60	6.80	86	2.49	8	9.30	34	8.62	60	6.40	86	2.42
9	10.23	35	9.34	61	6.67	87	2.37	9	9.30	35	8.58	61	6.29	87	2.30
10	10.21	36	9.28	62	6.54	88	2.30	10	9.29	36	8.53	62	6.17	88	2.23
11	10.18	37	9.23	63	6.40	89	2.21	11	9.26	37	8.49	63	6.05	89	2.15
12	10.15	38	9.17	64	6 26	90	2.07	12	9.24	38	8.44	64	5.92	90	2.01
13	10.12	39	9.11	65	6.10	91	2.05	13	9.21	39	8.39	65	5.78	91	2.00
14	10.09	40	9.04	66	5.94	92	2.13	14	9.19	40	8.34	66	5.64	92	2.07
15	10.06	41	8.99	67	5.76	93	2.23	15	9.16	41	8.29	67	5.47	93	2.17
16	10.03	42	8.94	68	5.57	94	2.28	16	9.14	42	8.25	68	5.30	94	2.22
17	10.01	43	8.88	69	5.37	95	2.32	17	9.12	43	8.21	69	5.12	95	2.26
18	9.99	44	8.82	70	5.15	96	2.30	18	9.10	44	8.16	70	4.92	96	2.24
19	9.96	45	8.76	71	4.92	97	2.20	19	9.08	45	8.11	71	4.70	97	2.15
20	9.94	46	8.70	72	4.70	98	2.08	20	9.06	46	8.06	72	4.50	98	2.04
21	9.91	47	8.62	73	4.50	99	1.89	21	9.04	47	7.99	73	4.31	99	1.85
22	9.87	48	8.54	74	4.32	100	1.52	22	9.02	48	7.92	74	4.14	100	1.49
23	9.84	49	8.44	75	4.17	101	1.13	23	8.99	49	7.84	75	4.01	101	1.11
24	9.80	50	8.32	76	4.03	102	.72	24	8.96	50	7.74	76	3.87	102	.71
25	9.76	51	8.20	77	3.90	103	.31	25	8.92	51	7.63	77	3.75	103	.30

TABLE VIII.

The Present Value of an Annuity of One Pound on Two Joint Lives, according to the Carlisle Table of Mortality.

Example.—An Annuity of £100 to cease on the death of the first of two lives aged 30 and 40 is now worth, at 5 per cent. £1161.

Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.
Years.	Value.	Value.	Value.	Value.
5—0	14.38	12.20	10.55	9.27
5	19.82	16.80	14.51	12.72
10—0	14.41	12.28	10.65	9.38
5	19.87	16.91	14.65	12.87
10	19.96	17.05	14.80	13.04
15—0	13.98	11.97	10.42	9.21
5	19.29	16.49	14.34	12.63
10	19.41	16.64	14.50	12.80
15	18.91	16.27	14.21	12.58
20—0	13.56	11.68	10.21	9.05
5	18.72	16.10	14.05	12.42
10	18.87	16.26	14.22	12.59
15	18.42	15.92	13.96	12.38
20	17.99	15.61	13.72	12.21
25—5	18.02	15.59	13.67	12.14
10	18.19	15.77	13.85	12.31
15	17.79	15.46	13.61	12.12
20	17.42	15.18	13.40	11.95
25	16.92	14.80	13.10	11.72
30—5	17.22	15.00	13.23	11.80
10	17.41	15.22	13.42	11.97
15	17.06	14.92	13.20	11.79
20	16.75	14.70	13.01	11.65
25	16.31	14.34	12.74	11.43
30	15.78	13.93	12.42	11.17

Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.
Years.	Value.	Value.	Value.	Value.
35—5	16.39	14.39	12.77	11.45
10	16.60	14.59	12.96	11.63
15	16.29	14.35	12.76	11.46
20	16.03	14.14	12.60	11.33
25	15.66	13.85	12.37	11.14
30	15.21	13.49	12.08	10.90
35	14.72	13.11	11.78	10.67
40—5	15.39	13.63	12.19	10.99
10	15.61	13.83	12.38	11.17
15	15.35	13.62	12 20	11.02
20	15.13	13.45	12.06	10.90
25	14.82	13.20	11.86	10.73
30	14.45	12.90	11.61	10.53
35	14.05	12.58	11.35	10.32
40	13.48	12.13	10.98	10.01
45—5	14.38	12.86	11.59	10.52
10	14.60	13.07	11.78	10.70
15	14.38	12.88	11.66	10.57
20	14.21	12.74	11.51	10.47
25	13.95	12.53	11.34	10.32
30	13.65	12.28	11.12	10.14
35	13.33	12.02	10.91	9.97
40	12.87	11.64	10.60	9.70
45	12.37	11.24	10.28	9.44
50—5	13.09	11.83	10.76	9.85
10	13.31	12.04	10.95	10.03
15	13.13	11.88	10.82	9.91

TABLE VIII.—THE PRESENT VALUE OF AN ANNUITY OF ONE POUND ON TWO JOINT LIVES, &c.—*continued.*

Ages,	3 pr. Ct.	4 pr. Ct	5 pr. Ct.	6 pr. Ct.	Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.
Years.	Value.	Value.	Value.	Value.	Years.	Value.	Value.	Value.	Value.
50-20	12.99	11.77	10.73	9.83	65-25	8.33	7.78	7.30	6.86
25	12.79	11.60	10 58	9.71	30	8.22	7.69	7.21	6.78
30	12.55	11.39	10.40	9.55	35	8.14	7.61	7.14	6.72
35	12.31	11.20	10.24	9.41	40	8.01	7.49	7.03	6.62
40	11.95	10.90	9.98	9.20	45	7.91	7.41	6.96	6.56
45	11.58	10.59	9.74	8.99	50	7.69	7.22	6.80	6.42
50	10.94	10.06	9.29	8.62	55	7.22	6.80	6.42	6.07
					60	6.59	6.23	5.89	5.59
55—5	11.46	10.47	9.62	8.88	65	6.05	5.74	5.46	5.20
10	11.67	10.66	9.80	9.05					
15	11.53	10.54	9.69	8.95	70—5	6.74	6.35	6.01	5.69
20	11.43	10.46	9.62	8.89	10	6.87	6.48	6.13	5.81
25	11.27	10.33	9.51	8.79	15	6.82	6.43	6.08	5.77
30	11.09	10.16	9.36	8.67	20	6.79	6.41	6.06	5.75
35	10.92	10.02	9.24	8.56	25	6.74	6.36	6.02	5.71
40	10.66	9.80	9.05	8.39	30	6.66	6 29	5.95	5.65
45	10.40	9.58	8.87	8.24	35	6.61	6.24	5.91	5.61
50	9.92	9.18	8.53	7.95	40	6.52	6.16	5.83	5.54
55	9.10	8.46	7.90	7.40	45	6.46	6.11	5.79	5.50
					50	6.34	6.00	5.70	5.42
60—5	9.77	9.02	8.37	7.79	55	6.02	5.71	5.43	5.17
10	9.96	9.20	8.53	7.94	60	5.57	5.29	5.04	4.82
15	9.85	9.10	8.45	7.87	65	5.19	4.96	4.74	4.53
20	9.78	9.04	8.39	7.82	70	4.56	4.37	4.19	4.03
25	9.67	8.94	8.31	7.74					
30	9.53	8.82	8.20	7.64	75—5	5.24	4.99	4.76	4.54
35	9.41	8.72	8.11	7.56	10	5.35	5.09	4.86	4.64
40	9.22	8.55	7.96	7.44	15	5.31	5.06	4.82	4.60
45	9.06	8.42	7.85	7.34	20	5.30	5.04	4.81	4.59
50	8.73	8.13	7.60	7.13	25	5 26	5.01	4.78	4.57
55	8.10	7.57	7.11	6.69	30	5.21	4.96	4.74	4.52
60	7.30	6.85	6.46	6.10	35	5.18	4.93	4.71	4.50
					40	5.11	4.87	4.65	4.45
65—5	8.37	7.81	7.32	6.87	45	5.09	4.85	4.63	4.43
10	8.54	7.97	7.46	7.01	50	5.02	4.79	4.58	4.38
15	8.46	7.90	7.40	6.95	55	4.81	4.60	4.40	4 22
20	8.41	7.86	7.36	6.92	60	4.50	4.30	4.13	3.96

TABLE VIII.—THE PRESENT VALUE OF AN ANNUITY OF ONE POUND ON TWO JOINT LIVES, &c.—*continued.*

Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.	Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.
Years.	Value.	Value.	Value.	Value.	Years.	Value.	Value.	Value.	Value.
75–65	4.26	4.08	3.92	3.77	85–45	3.06	2.95	2.85	2.76
70	3.80	3.66	3.53	3.40	50	3.04	2.94	2.84	2.75
75	3.23	3.12	3.02	2.92	55	2.96	2.86	2.77	2.69
					60	2.81	2.72	2.64	2.56
80—5	4.17	4.00	3.85	3.70	65	2.72	2.64	2.56	2 48
10	4.26	4.09	3.93	3.78	70	2.52	2.45	2.38	2.32
15	4.23	4.06	3.90	3.75	75	2.22	2.16	2.10	2.05
20	4.22	4.05	3.89	3.74	80	1.99	1.94	1.90	1.85
25	4.20	4.03	3.87	3.73	85	1.66	1.62	1.58	1.55
30	4.17	4.00	3.84	3.70					
35	4.15	3.98	3.83	3.68	90–10	2.45	2.37	2.30	2.23
40	4.10	3.94	3.78	3.64	15	2.44	2.36	2.29	2.22
45	4.09	3.92	3.77	3.63	20	2.44	2.36	2.28	2.21
50	4.05	3.89	3.75	3.61	25	2.43	2.35	2.28	2.21
55	3.92	3.77	3.63	3.50	30	2.41	2.33	2.26	2.19
60	3.70	3.56	3.43	3.31	35	2.40	2.32	2.25	2.18
65	3.54	3.42	3.30	3.19	40	2.38	2.30	2.23	2 17
70	3.23	3.12	3.02	2.93	45	2.37	2.30	2.23	2.16
75	2.79	2.70	2.62	2.55	50	2.36	2.29	2.22	2.15
80	2.46	2.39	2.32	2.26	55	2.31	2.24	2.17	2.11
					60	2.20	2.13	2.07	2.01
85—5	3.10	2.99	2.89	2.80	65	2.13	2.07	2.01	1.95
10	3.17	3.06	2.95	2.86	70	1.99	1.93	1.88	1.83
15	3.15	3.04	2.94	2.84	75	1.76	1.71	1.67	1.63
20	3.14	3.03	2.93	2.84	80	1.59	1.55	1.52	1.48
25	3.13	3.02	2.92	2.83	85	1.34	1.31	1.28	1.25
30	3.11	3.00	2.90	2.81	90	1.09	1.07	1.05	1.03
35	3.10	2.99	2.89	2.80	95	1.22	1.19	1.17	1.14
40	3.07	2.96	2.86	2.77	100	0.98	0.96	0 95	0.94

TABLE IX.

THE PRESENT VALUE OF ONE POUND PER ANNUM HELD ON THE LONGEST OF TWO LIVES, ACCORDING TO THE CARLISLE TABLE OF MORTALITY.

Example.—A Lease held on the longest of two lives of the respective ages of 30 and 50 is worth at the present time 15.98 years' purchase, if the purchaser expects 5 per cent. for his money and can invest the reserved sum at the same rate.

Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.	Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.
Years.	Value.	Value.	Value.	Value.	Years.	Value.	Value.	Value.	Value.
5—5	27.57	22.38	18.67	15.93	35—5	25.74	21.24	17.94	15.45
					10	25.35	21.03	17.83	15.39
10—5	27.33	22.26	18.61	15.90	15	24.72	20.65	17.59	15.24
10	27.06	22.12	18.54	15.86	20	24.10	20.26	17.34	15.08
					25	23.44	19.84	17.06	14.89
15—5	26.99	22.05	18.48	15.82	30	22.78	19.40	16.77	14.69
10	26.68	21.90	18.40	15.77	35	22.15	18.97	16.47	14.48
15	26.26	21.64	18.24	15.67					
					40—5	25.44	21.03	17.79	15.34
20—5	26.67	21.86	18.36	15.74	10	25.05	20.82	17.68	15.28
10	26.33	21.68	18.27	15.69	15	24.38	20.41	17.42	15.11
15	25.85	21.39	18.09	15.58	20	23.71	19.98	17.15	14.93
20	25.40	21.11	17.91	15.46	25	22.99	19.51	16.84	14.72
					30	22.25	19.03	16.50	14.50
25—5	26.34	21.65	18.22	15.65	35	21.53	18.53	16.16	14.2
10	25.99	21.46	18.12	15.59	40	20.80	18.02	15.80	13.99
15	25.45	21.14	17.92	15.47					
20	24.94	20.82	17.72	15.34	45—5	25.17	20.84	17.65	15.23
25	24.42	20.49	17.51	15.20	10	24.77	20.62	17.53	15.17
					15	24.06	20.18	17.22	14.98
30—5	26.03	21.44	18.08	15.55	20	23.35	19.73	16.95	14.79
10	25.66	21.21	17.97	15.50	25	22.58	19.22	16.62	14.56
15	25.08	20.89	17.76	15.35	30	21.77	18.68	16.25	14.31
20	24.50	20.54	17.53	15.21	35	20.97	18.12	15.86	14.03
25	23.91	20.16	17.28	15.01	40	20.14	17.53	15.44	13.73
30	23.33	19.77	17.03	14.87	45	19.35	16.97	15.02	13.41

TABLE IX.—THE PRESENT VALUE OF ONE POUND PER ANNUM HELD ON THE LONGEST OF TWO LIVES, &c.—*continued.*

Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.	Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct
Years.	Value.	Value.	Value.	Value.	Years.	Value.	Value.	Value.	Value.
50—5	24.90	20.63	17.49	15.11	65—5	24.24	20.09	17.04	14.74
10	24.50	20.42	17.38	15.05	10	23.89	19.92	16.97	14.72
15	23.75	19.94	17.07	14.84	15	23.04	19.37	16.60	14.46
20	23.00	19.46	16.75	14.63	20	22.20	18.81	16.22	14.20
25	22.18	18.92	16.38	14.38	25	21.26	18.17	15.77	13.88
30	21.31	18.33	15.98	14.10	30	20.25	17.47	15.28	13.52
35	20.42	17.72	15.55	13.79	35	19.21	16.73	14.75	13.13
40	19.49	17.05	15.06	13.44	40	18.05	15.89	14.12	12.66
45	18.59	16.38	14.57	13.07	45	16.87	15.00	13.45	12.15
50	17.66	15.68	14.03	12.64	50	15.53	13.96	12.63	11.50
					55	14.11	12.81	11.69	10.73
55—5	24.64	20.42	17.32	14.97	60	12.82	11.75	10.81	9.99
10	24.25	20.22	17.22	14.92	65	11.79	10.88	10.07	9.37
15	23.46	19.71	16.88	14.70					
20	22.68	19.20	16.54	14.47	70—5	24.08	19.95	16.92	14.63
25	21.80	18.62	16.15	14.19	10	23.76	19.81	16.87	14.64
30	20.88	17.99	15.71	13.88	15	22.89	19.23	16.48	14.36
35	19.92	17.32	15.23	13.54	20	22.03	18.66	16.09	14.09
40	18.89	16.58	14.69	13.14	25	21.05	18.00	15.62	13.75
45	17.87	15.82	14.12	12.71	30	20.02	17.27	15.10	13.37
50	16.79	14.99	13.48	12.20	35	18.95	16.51	14.55	12.96
55	15.71	14.13	12.79	11.65	40	17.75	15.63	13.89	12.46
					45	16.52	14.70	13.19	11.92
60—5	24.41	20.23	17.16	14.84	50	15.09	13.58	12.30	11.21
10	24.05	20.05	17.08	14.81	55	13.51	12.30	11.25	10.35
15	23.22	19.51	16.72	14.56	60	12.05	11.08	10.23	9.49
20	22.40	18.98	16.36	14.32	65	10.85	10.06	9.36	8.74
25	21.49	18.36	15.94	14.02	70	9.69	9.05	8.48	7.97
30	20.52	17.70	15.47	13.68					
35	19.52	16.99	14.96	13.31	75—5	23.96	19.84	16.82	14.54
40	18.42	16.18	14.37	12.87	10	23.67	19.73	16.80	14.57
45	17.29	15.35	13.74	12.39	15	22.78	19.14	16.40	14.28
50	16.06	14.40	13.00	11.81	20	21.91	18.56	16.00	14.00
55	14.80	13.39	12.18	11.14	25	20.92	17.87	15.52	13.65
60	13.69	12.47	11.42	10.51	30	19.86	17.13	14.98	13.26

TABLE IX.—THE PRESENT VALUE OF ONE POUND PER ANNUM HELD ON THE LONGEST OF TWO LIVES, &c.—*continued.*

Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.	Ages.	3 pr. Ct.	4 pr. Ct.	5 pr. Ct.	6 pr. Ct.
Years.	Value.	Value.	Value.	Value.	Years.	Value.	Value.	Value.	Value.
75–35	18.77	16.35	14.41	12.83	85–25	20.77	17.74	15.39	13.54
40	17.54	15.44	13.73	12.32	30	19.68	16.97	14.83	13.12
45	16.29	14.49	13.01	11.76	35	18.57	16.17	14.25	12.68
50	14.79	13.32	12.07	11.01	40	17.31	15.23	13.53	12.14
55	13.11	11.94	10.94	10.07	45	16.04	14.27	12.80	11.57
60	11.51	10.60	9.80	9.11	50	14.49	13.05	11.83	10.79
65	10.17	9.46	8.83	8.27	55	12.68	11.55	10.58	9.75
70	8.83	8.29	7.80	7.35	60	10.91	10.06	9.31	8.66
75	7.79	7.36	6.96	6.60	65	9.43	8.80	8.22	7.71
					70	7.83	7.38	6.96	6.59
80—5	23.88	19.77	16.76	14.49	75	6.52	6.20	5.90	5.62
10	23.61	19.68	16.76	14.49	80	5.60	5.36	5.13	4.92
15	22.71	19.08	16.34	14.23	85	4.80	4.61	4.43	4.27
20	21.84	18.49	15.94	13.95					
25	20.84	17.79	15.44	13.59	90–10	23.56	19.62	16.71	14.48
30	19.75	17.04	14.89	13.18	15	22.64	19.01	16.28	14.18
35	18.65	16.24	14.32	12.75	20	21.76	18.42	15.87	13.89
40	17.41	15.32	13.62	12.22	25	20.74	17.71	15.37	13.52
45	16.14	14.36	12.89	11.66	30	19.64	16.94	14.80	13.09
50	14.61	13.16	11.93	10.88	35	18.53	16.13	14.21	12.66
55	12.85	11.71	10.73	9.88	40	17.26	15.19	13.50	12.10
60	11.16	10.29	9.52	8.85	45	15.99	14.22	12.76	11.53
65	9.74	9.07	8.48	7.95	50	14.44	13.00	11.78	10.74
70	8.26	7.77	7.33	6.93	55	12.60	11.48	10.52	9.68
75	7.09	6.72	6.38	6.07	60	10.79	9.95	9.21	8.56
80	6.27	5.98	5.71	5.46	65	9.29	8.65	8.09	7.59
					70	7.63	7.19	6.79	6.43
85—5	23.82	19.71	16.71	14.44	75	6.25	5.94	5.66	5.40
10	23.57	19.64	16.72	14.50	80	5.27	5.05	4.84	4.64
15	22.66	19.03	16.30	14.19	85	4.39	4.22	4.07	3.92
20	21.78	18.44	15.89	13.91	90	3.91	3.77	3.63	3.51

TABLE X.

The Present Value of One Pound per Annum held on the Longest of Three Lives, according to the Carlisle Table of Mortality.

Example.—A Lease held on the longest of three lives of the respective ages of 50, 40, and 30, is worth at the present time 16.8 years' purchase at 5 per cent.

Ages.	3 per Cent.	4 per Cent.	5 per Cent.	6 per Cent.
Years.	Value.	Value.	Value.	Value.
10—10—10	23.30	22.89	19.01	16.17
10—15—15	27.84	22.65	18.88	16.10
10—20—10	27.89	22.66	18.89	16.11
20	27.37	22.37	18.71	15.99
10—25—15	27.42	22.40	18.73	16.00
25	26.93	22.10	18.54	15.88
10—30—10	27.56	22.46	18.77	16.03
20	26.98	22.14	18.56	15.90
30	26.50	21.85	18.40	15.79
10—35—15	27.12	22.21	18.62	15.93
25	26.56	21.87	18.40	15.78
35	26.08	21.56	18.22	15.67
10—40—10	27.33	22.32	18.66	15.94
20	26.70	21.95	18.44	15.82
30	26.13	21.59	18.23	15.69
40	25.66	21.27	18.00	15.52
10—45—15	26.92	22.04	18.50	15.85
25	26.26	21.61	18.26	15.70
35	25.70	21.30	18.01	15.53
45	25.25	20.99	17.80	15.38
10—50—10	27.16	22.18	18.56	15.86
20	26.46	21.72	18.32	15.72
30	25.84	21.38	18.08	15.57
40	25.30	21.02	17.81	15.37
50	24.87	20.70	17.58	15.20
10—55—15	26.73	21.92	18.40	15.76
25	26.06	21.51	18.14	15.60
35	25.46	21.12	17.88	15.42
45	24.94	20.75	17.63	15.25
55	24.54	20.45	17.40	17.07

TABLE X.—THE PRESENT VALUE OF ONE POUND PER ANNUM, &c.—*continued.*

Ages.	3 per Cent.	4 per Cent.	5 per Cent.	6 per Cent.	Ages.	3 per Cent.	4 per Cent.	5 per Cent.	6 per Cent.
Years.	Value.	Value.	Value.	Value.	Years.	Value.	Value.	Value.	Value.
10—60—10	27.06	22.12	18.51	15.82	15—40—40	25.08	20.93	17.82	15.42
20	26.35	21.70	18.25	15.67	15—50—20	26.02	21.51	18.18	15.64
30	25.70	21.37	17.98	15.50	30	25.30	21.06	17.88	15.45
40	25.12	20.87	17.72	15.30	40	24.68	20.64	17.60	15.25
50	24.62	20.51	17.43	15.08	50	24.18	20.27	17.33	15.05
60	24.27	20.23	17.22	14.93	15—60—20	25.89	21.42	18.10	15.58
10—65—15	26.68	21.88	18.35	15.72	30	25.14	20.94	17.80	15.38
25	25.98	21.45	18.09	15.55	40	24.47	20.48	17.48	15.15
35	25.36	21.04	17.81	15.37	50	23.90	20.06	17.16	14.91
45	24.80	20.64	17.53	15.16	15—70—20	25.82	21.36	18.05	15.54
55	24.33	20.27	17.26	14.95	30	25.06	20.87	17.73	15.32
65	24.03	20.04	17.05	14.79	40	24.37	20.39	17.40	15.09
10—70—10	27.02	22.08	18.51	15.83	50	23.76	19.94	17.06	14.83
20	26.30	21.65	18.25	15.67	60	23.27	19.55	16.75	14.58
30	25.63	21.22	17.96	15.47	70	23.00	19.32	16.56	14.43
40	25.03	20.80	17.66	15.26	20—20—20	26.78	22.04	18.54	15.90
50	24.50	20.41	17.35	15.02	20—30—20	26.25	21.72	18.35	15.78
60	24.08	20.07	17.09	14.82	30	25.62	21.34	18.12	15.63
70	23.85	19.88	16.93	14.68	20—40—20	25.87	21.47	18.18	15.66
15—20—20	27.06	22.20	18.65	15.96	30	25.13	21.00	17.88	15.48
15—30—20	26.60	21.92	18.47	15.86	40	24.50	20.59	17.60	15.28
30	26.05	21.60	18.26	15.73	20—50—20	25.58	21.25	18.01	15.53
15—40—20	26.27	21.71	18.33	15.75	30	24.76	20.73	17.68	15.32
30	25.62	21.30	18.06	15.58	40	24.05	20.25	17.35	15.09

TABLE X.—THE PRESENT VALUE OF ONE POUND PER ANNUM &c.—*continued.*

Ages.	3 per Cent.	4 per Cent.	5 per Cent.	6 per Cent.	Ages.	3 per Cent.	4 per Cent.	5 per Cent.	6 per Cent.
Years.	Value.	Value.	Value.	Value.	Years.	Value.	Value.	Value.	Value.
20—50—50	23.50	19.84	17.04	14.86	30—70—50	21.34	18 35	16.00	14.11
20—60—20	25.44	21.15	17.93	15.47	60	20 62	17.78	15.54	13.74
30	24.58	20 60	17.57	15.24	70	20.21	17.44	15.25	13.50
40	23.82	20.08	17.21	14.98	40—40—40	22.35	19.18	16.70	14.68
50	23.17	19.60	16.86	14.72	40—50—40	21.48	18.56	16.22	14.32
60	21.71	19.24	16.57	14.50	50	20.41	17.72	15.65	13.90
20—70—20	25.37	21.08	17.89	15.43	40—60—40	21.05	18.22	15.96	14.12
30	24.49	20.52	17.51	15.18	50	19.83	17.33	15.29	13.62
40	23.70	19.98	17.13	14.92	60	19.60	16.67	14.78	13.22
50	23.01	19.46	16.74	14 62	40—70—40	20.83	18.04	15.82	14.00
60	22.47	19 03	16.40	14.35	50	19.55	17.09	15.10	13.46
70	22 16	18.77	16.18	14.17	60	18.56	16.31	14.48	12.96
30—30—30	24 80	20.87	17.83	15.46	70	18.02	15.86	14.10	12.65
30—40—30	24.18	20.42	17.52	15.24	50—50—50	19.06	16.77	14.90	13.33
40	23.34	19.85	17.14	14.98	50—60—50	18.20	16.12	14.40	12.95
30—50—30	23.63	20.04	17.24	15.03	60	16.95	15.14	13.62	12.33
40	22.72	19.39	16.80	14.73	50—70—50	17.76	15.77	14.08	12.69
50	21.97	18.84	16.39	14.42	60	16.30	14.60	13.17	11.95
30—60—30	23.45	19.87	17.11	14.93	70	15.48	13.92	12.60	11.47
40	22.42	19.16	16.62	14.58	60—60—60	15.21	13.76	12.54	11.46
50	21.56	18.53	16.14	14.23	60—70—60	14.16	12.88	11.80	10.83
60	20.95	18.05	15.77	14.93	70	12.84	11.77	10.86	10.04
30—70—30	23.32	19.76	17.02	14.85	70—70—70	10.98	10.20	9.49	8.86
40	22.26	19.03	16.51	14.49					

TABLE XI.

THE PRESENT VALUE OF THE REVERSION TO ONE POUND AT THE END OF THE YEAR AFTER A LIFE DROPS, ACCORDING TO THE CARLISLE TABLE OF MORTALITY.

Example.—The present value of an Assurance of £100 to be paid one year after the death of a person aged 30 is £25.1 at 5 per cent.

3 per Cent.							
Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.
1	.386	26	.375	51	.565	76	.817
2	.345	27	.382	52	.576	77	.824
3	.310	28	.389	53	.587	78	.830
4	.293	29	.395	54	.598	79	.837
5	.281	30	.401	55	.609	80	.844
6	.276	31	.407	56	.621	81	.851
7	.276	32	.414	57	.633	82	.857
8	.278	33	.420	58	.644	83	.864
9	.281	34	.427	59	.655	84	.870
10	.286	35	.434	60	.665	85	.877
11	.291	36	.441	61	.674	86	.883
12	.297	37	.449	62	.683	87	.887
13	.302	38	.456	63	.692	88	.890
14	.308	39	.464	64	.702	89	.893
15	.313	40	.472	65	.711	90	.898
16	.318	41	.479	66	.721	91	.899
17	.323	42	.486	67	.731	92	.896
18	.328	43	.494	68	.742	93	.893
19	.334	44	.501	69	.752	94	.891
20	.339	45	.509	70	.763	95	.891
21	.345	46	.517	71	.775	96	.892
22	.350	47	.525	72	.785	97	.896
23	.356	48	.534	73	.795	98	.901
24	.363	49	.544	74	.803	99	.909
25	.369	50	.554	75	.810	100	.922

TABLE XI.—THE PRESENT VALUE OF THE REVERSION TO ONE POUND, &c.—*continued.*

3½ per Cent.								4 per Cent.							
Age.	Value.	Age.	Value.	Age	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value.
1	.352	26	.328	51	.519	76	.792	1	.325	26	.289	51	.478	76	.769
2	.308	27	.335	52	.531	77	.799	2	.280	27	.295	52	.490	77	.776
3	.272	28	.341	53	.542	78	.806	3	.242	28	.302	53	.502	78	.784
4	.253	29	.348	54	.554	79	.814	4	.222	29	.308	54	.514	79	.793
5	.240	30	.353	55	.566	80	.822	5	.208	30	.313	55	.527	80	.801
6	.235	31	.359	56	.578	81	.830	6	.202	31	.319	56	.540	81	.809
7	.235	32	.365	57	.591	82	.837	7	.200	32	.325	57	.553	82	.817
8	.235	33	.372	58	.603	83	.844	8	.201	33	.331	58	.566	83	.826
9	.238	34	.379	59	.615	84	.852	9	.204	34	.338	59	.578	84	.834
10	.243	35	.386	60	.626	85	.859	10	.208	35	.345	60	.590	85	.842
11	.248	36	.393	61	.636	86	.865	11	.213	36	.352	61	.600	86	.849
12	.253	37	.400	62	.645	87	.871	12	.218	37	.359	62	.610	87	.855
13	.258	38	.408	63	.655	88	.874	13	.223	38	.366	63	.620	88	.858
14	.263	39	.416	64	.665	89	.878	14	.228	39	.374	64	.631	89	.862
15	.268	40	.423	65	.675	90	.883	15	.232	40	.382	65	.642	90	.869
16	.273	41	.431	66	.686	91	.883	16	.237	41	.389	66	.653	91	.869
17	.278	42	.438	67	.697	92	.880	17	.241	42	.396	67	.665	92	.866
18	.283	43	.445	68	.709	93	.876	18	.246	43	.404	68	.678	93	.862
19	.288	44	.453	69	.720	94	.875	19	.251	44	.411	69	.690	94	.860
20	.293	45	.461	70	.732	95	.874	20	.255	45	.419	70	.703	95	.859
21	.298	46	.469	71	.745	96	.876	21	.260	46	.427	71	.717	96	.860
22	.304	47	.478	72	.757	97	.880	22	.266	47	.436	72	.730	97	.866
23	.310	48	.487	73	.767	98	.886	23	.271	48	.445	73	.741	98	.872
24	.316	49	.497	74	.777	99	.894	24	.277	49	.456	74	.752	99	.881
25	.322	50	.508	75	.785	100	.909	25	.283	50	.467	75	.760	100	.898

TABLE XI.—THE PRESENT VALUE OF THE REVERSION TO ONE POUND, &c.—*continued*

5 per Cent.								6 per Cent.							
Age.	Value.	Age.	Value.	Age	Value.	Age.	Value.	Age.	Value.	Age.	Value.	Age	Value.	Age.	Value.
1	.286	26	.229	51	.409	76	.724	1	.260	26	.187	51	.353	76	.684
2	.239	27	.235	52	.421	77	.733	2	.212	27	.192	52	.366	77	.694
3	.199	28	.241	53	.434	78	.742	3	.171	28	.197	53	.378	78	.704
4	.178	29	.246	54	.446	79	.752	4	.149	29	.202	54	.391	79	.715
5	.162	30	.251	55	.460	80	.761	5	.133	30	.206	55	.404	80	.725
6	.155	31	.256	56	.473	81	.771	6	.125	31	.211	56	.418	81	.736
7	.153	32	.262	57	.487	82	.781	7	.122	32	.215	57	.432	82	.747
8	.153	33	.267	58	.501	83	.790	8	.121	33	.221	58	.447	83	.757
9	.155	34	.273	59	.514	84	.799	9	.123	34	.226	59	.461	84	.768
10	.159	35	.280	60	.527	85	.809	10	.126	35	.232	60	.473	85	.779
11	.163	36	.286	61	.538	86	.818	11	.129	36	.238	61	.484	86	.788
12	.167	37	.293	62	.548	87	.825	12	.133	37	.244	62	.495	87	.796
13	.171	38	.300	63	.559	88	.829	13	.136	38	.251	63	.507	88	.801
14	.175	39	.308	64	.571	89	.834	14	.140	39	.257	64	.519	89	.807
15	.180	40	.315	65	.583	90	.841	15	.144	40	.264	65	.531	90	.815
16	.184	41	.322	66	.595	91	.842	16	.147	41	.270	66	.544	91	.816
17	.187	42	.329	67	.608	92	.838	17	.150	42	.277	67	.558	92	.811
18	.191	43	.335	68	.622	93	.833	18	.153	43	.283	68	.573	93	.805
19	.195	44	.343	69	.636	94	.830	19	.157	44	.290	69	.588	94	.802
20	.199	45	.350	70	.651	95	.829	20	.160	45	.297	70	.604	95	.801
21	.203	46	.358	71	.666	96	.831	21	.164	46	.304	71	.621	96	.803
22	.208	47	.367	72	.680	97	.837	22	.168	47	.312	72	.636	97	.809
23	.213	48	.376	73	.694	98	.844	23	.172	48	.321	73	.651	98	.817
24	.218	49	.386	74	.705	99	.855	24	.177	49	.331	74	.664	99	.830
25	.224	50	.397	75	.715	100	.875	25	.182	50	.342	75	.674	100	.853

TABLE XI.—THE PRESENT VALUE OF THE REVERSION TO ONE POUND, &c.—*continued.*

7 per Cent.								8 per Cent.							
Age.	Value.	Age.	Value.	Age.	Value.	Age.	Value	Age	Value.	Age.	Value.	Age.	Value.	Age.	Value
1	.241	26	.156	51	.308	76	.648	1	.221	26	.133	51	.271	76	.615
2	.193	27	.161	52	.320	77	.658	2	.179	27	.137	52	.283	77	.625
3	.151	28	.165	53	.332	78	.669	3	.137	28	.141	53	.295	78	.636
4	.128	29	.170	54	.345	79	.681	4	.114	29	.145	54	.307	79	.649
5	.112	30	.173	55	.358	80	.692	5	.097	30	.148	55	.320	80	.661
6	.104	31	.177	56	.372	81	.704	6	.089	31	.152	56	.334	81	.674
7	.100	32	.181	57	.387	82	.715	7	.085	32	.155	57	.348	82	.686
8	.099	33	.186	58	.401	83	.727	8	.084	33	.159	58	.363	83	.699
9	.100	34	.190	59	.415	84	.738	9	.084	34	.163	59	.376	84	.711
10	.103	35	.196	60	.428	85	.750	10	.086	35	.168	60	.389	85	.724
11	.106	36	.201	61	.439	86	.761	11	.089	36	.173	61	.400	86	.735
12	.109	37	.207	62	.450	87	.770	12	.092	37	.178	62	.411	87	.745
13	.112	38	.213	63	.462	88	.775	13	.095	38	.183	63	.423	88	.751
14	.115	39	.219	64	.474	89	.781	14	.097	39	.189	64	.435	89	.757
15	.119	40	.225	65	.487	90	.791	15	.100	40	.195	65	.448	90	.768
16	.121	41	.231	66	.500	91	.792	16	.103	41	.200	66	.461	91	.769
17	.124	42	.236	67	.515	92	.786	17	.105	42	.205	67	.476	92	.763
18	.127	43	.242	68	.530	93	.780	18	.107	43	.210	68	.491	93	.756
19	.130	44	.248	69	.546	94	.776	19	.109	44	.215	69	.508	94	.752
20	.133	45	.254	70	.562	95	.774	20	.112	45	.221	70	.525	95	.749
21	.136	46	.261	71	.580	96	.775	21	.115	46	.227	71	.544	96	.751
22	.139	47	.269	72	.597	97	.783	22	.118	47	.234	72	.561	97	.759
23	.143	48	.277	73	.612	98	.792	23	.121	48	.241	73	.577	98	.768
24	.147	49	.286	74	.626	99	.806	24	.125	49	.250	74	.592	99	.783
25	.151	50	.297	75	.637	100	.832	25	.129	50	.260	75	.603	100	.812

TABLE XII.

THE PRESENT VALUE OF AN ANNUITY OF ONE POUND HELD DURING A SINGLE LIFE, ACCORDING TO THE NORTHAMPTON TABLE OF MORTALITY.

Example.—A Lease or an Annuity of £100 held for a life aged 40 is worth at the present time £1184, interest being reckoned at 5 per cent.

Age.	3 per Cnt.	4 per Cnt.	5 per Cnt.	6 per Cnt.	7 per Cnt.	8 per Cnt.	Age.
Years.	Value.	Value.	Value.	Value.	Value.	Value.	Years.
Birth.	12.27	10.33	8.86	7.78	6.91	6.22	Birth.
1	16.02	13.47	11.56	10.11	8.96	8.05	1
2	18.60	15.63	13.42	11.72	10.39	9.32	2
3	19.58	16.46	14.14	12.35	10.94	9.81	3
4	20.21	17.01	14.61	12.77	11.32	10.15	4
5	20.47	17.25	14.83	12.96	11.49	10.30	5
6	20.73	17.48	15.04	13.16	11.67	10.47	6
7	20.85	17.61	15.17	13.28	11.78	10.57	7
8	20.89	17.66	15.23	13.34	11.84	10.63	8
9	20.81	17.63	15.21	13.33	11.84	10.63	9
10	20.66	17.52	15.14	13.29	11.81	10.61	10
11	20.48	17.39	15.04	13.21	11.75	10.57	11
12	20.28	17.25	14.94	13.13	11.69	10.52	12
13	20.08	17.10	14.83	13.04	11.62	10.46	13
14	19.87	16.95	14.71	12.95	11.55	10.40	14
15	19.66	16.79	14.59	12.86	11.47	10.34	15
16	19.44	16.62	14.46	12.76	11.38	10.27	16
17	19.22	16.46	14.33	12.66	11.30	10.20	17
18	19.01	16.31	14.22	12.56	11.23	10.14	18
19	18.82	16.17	14.11	12.48	11.16	10.08	19
20	18.64	16.03	14.01	12.40	11.09	10.03	20
21	18.47	15.91	13.92	12.33	11.04	9.99	21
22	18.31	15.80	13.83	12.27	10.99	9.95	22
23	18.15	15.68	13.75	12.20	10.94	9.91	23
24	17.98	15.56	13.66	12.13	10.89	9.87	24

TABLE XII.—THE PRESENT VALUE OF ONE POUND PER ANNUM, HELD ON A SINGLE LIFE, &c.—*continued.*

Age.	3 per Cnt.	4 per Cnt.	5 per Cnt	6 per Cnt.	7 per Cnt.	8 per Cnt.	Age.
Years.	Value.	Value.	Value.	Value.	Value.	Value.	Years.
25	17.81	15.44	13.57	12.06	10.84	9.82	25
26	17.64	15.31	13.47	11.99	10.78	9.78	26
27	17.47	15.18	13.38	11.92	10.72	9.73	27
28	17.29	15.05	13.28	11.84	10.66	9.69	28
29	17.11	14.92	13.18	11.76	10.60	9.64	29
30	16.92	14.78	13.07	11.68	10.54	9.58	30
31	16.73	14.64	12.97	11.60	10.47	9.53	31
32	16.54	14.50	12.85	11.51	10.40	9.48	32
33	16.34	14.35	12.74	11.42	10.33	9.42	33
34	16.14	14.20	12.62	11.33	10.26	9.36	34
35	15.94	14.04	12.50	11.24	10.18	9.30	35
36	15.73	13.88	12.38	11.14	10.10	9.23	36
37	15.52	13.72	12.25	11.04	10.02	9.16	37
38	15.30	13.55	12.12	10.93	9.94	9.09	38
39	15.08	13.38	11.98	10.82	9.85	9.02	39
40	14.85	13.20	11.84	10.71	9.75	8.94	40
41	14.62	13.02	11.70	10 59	9.66	8.86	41
42	14.39	12.84	11.55	10.47	9.56	8.78	42
43	14.16	12.66	11.41	10.36	9.47	8.70	43
44	13.93	12.47	11.26	10.24	9.37	8.62	44
45	13.69	12.28	11.11	10.11	9.26	8.53	45
46	13.45	12.09	10.95	9.98	9.15	8.44	46
47	13.20	11.89	10.78	9.85	9.04	8.35	47
48	12.95	11.69	10.62	9.71	8.93	8.25	48
49	12.69	11.48	10.44	9.56	8.80	8.15	49
50	12.44	11.26	10.27	9.42	8.68	8.04	50
51	12.18	11.06	10.10	9.27	8.56	7.94	51
52	11.93	10.85	9.93	9.13	8.44	7.83	52
53	11.67	10.64	9.75	8.98	8.31	7.73	53
54	11.41	10 42	9.57	8.83	8.18	7.61	54
55	11.15	10.20	9.38	8.67	8.05	7.50	55
56	10.88	9.98	9.19	8.51	7.91	7.38	56
57	10.61	9.75	9.00	8.34	7.77	7.26	57
58	10.34	9.52	8.80	8.17	7.62	7.13	58
59	10.06	9.28	8.60	8.00	7.47	7.00	59

TABLE XII.—THE PRESENT VALUE OF ONE POUND PER ANNUM, HELD ON A SINGLE LIFE, &c.—*continued.*

Age.	3 per Cnt.	4 per Cnt.	5 per Cnt.	6 per Cnt.	7 per Cnt.	8 per Cnt.	Age.
Years.	Value.	Value.	Value.	Value.	Value.	Va'u	Years.
60	9.78	9.04	8.39	7.82	7.31	6.86	60
61	9.49	8.80	8.18	7.64	7.15	6.72	61
62	9.21	8.55	7.97	7.45	6.99	6.57	62
63	8.91	8.29	7.74	7.25	6.82	6.42	63
64	8.61	8.03	7.51	7.05	6 64	6.26	64
65	8.30	7.76	7.28	6.84	6.45	6.10	65
66	7.99	7.49	7.03	6.63	6.26	5.92	66
67	7.68	7.21	6.79	6.41	6.06	5.74	67
68	7.37	6.93	6.54	6.18	5.86	5.56	68
69	7.05	6.65	6.28	5.95	5.65	5.37	69
70	6.73	6.36	6.02	5.72	5.43	5.18	70
71	6.42	6.08	5.76	5.48	5.22	4.98	71
72	6.10	5.79	5.50	5.24	5.00	4.78	72
73	5.79	5.51	5.25	5.00	4.78	4.58	73
74	5.49	5.23	4.99	4.77	4.57	4.38	74
75	5.20	4.96	4.74	4.54	4.35	4.18	75
76	4.93	4.71	4.51	4.33	4.15	3.99	76
77	4.65	4.46	4.28	4.11	3.95	3.81	77
78	4.37	4.20	4.04	3.88	3.74	3.61	78
79	4.08	3.92	3.78	3.64	3.51	3.39	79
80	3.78	3.64	3.52	3.39	3.28	3.17	80
81	3.50	3.38	3.26	3.16	3.06	2.96	81
82	3.23	3.12	3.02	2.93	2 84	2.75	82
83	2.98	2.89	2.80	2.71	2.63	2.56	83
84	2.79	2.71	2.63	2.55	2.48	2.41	84
85	2.62	2.54	2.47	2.40	2.34	2.28	85
86	2.46	2.39	2.33	2.27	2.21	2.15	86
87	2.31	2.25	2.19	2.14	2.09	2.04	87
88	2.19	2.13	2.08	2.03	1.98	1.94	88
89	2.01	1.97	1.92	1.88	1.84	1.80	89
90	1.79	1.76	1.72	1.69	1.66	1.63	90
91	1.50	1.47	1.45	1.42	1.40	1.37	91
92	1.19	1.17	1.15	1.14	1.12	1.10	92
93	.84	.83	.82	.81	.80	.79	93
94	.54	.53	.52	.52	51	.51	94
95	.24	.24	.24	.24	.23	.23	95

TABLE XIII.

THE DECIMAL PARTS OF ONE POUND.

s.	d.	Decim.	s.	d.	Decim.	s.	d.	Decim	s.	d.	Decim.
0	$0\frac{1}{2}$	.0021	3	0	.1500	6	0	.3000	9	0	.4500
	1	.0041		1	.1541		1	.3041		1	.4541
	2	.0083		2	.1583		2	.3083		2	.4583
	3	.0125		3	.1625		3	.3125		3	.4625
	4	.0166		4	.1666		4	.3166		4	.4666
	5	.0208		5	.1708		5	.3208		5	.4708
	6	.0250		6	.1750		6	.3250		6	.4750
	7	.0291		7	.1791		7	.3291		7	.4791
	8	.0333		8	.1833		8	.3333		8	.4833
	9	.0375		9	.1875		9	.3375		9	.4875
	10	.0416		10	.1916		10	.3416		10	.4916
	11	.0458		11	.1958		11	.3458		11	.4958
1	0	.0500	4	0	.2000	7	0	.3500	10	0	.5000
	1	.0541		1	.2041		1	.3541		1	.5041
	2	.0583		2	.2083		2	.3583		2	.5083
	3	.0625		3	.2125		3	.3625		3	.5125
	4	.0666		4	.2166		4	.3666		4	.5166
	5	.0708		5	.2208		5	.3708		5	.5208
	6	.0750		6	.2250		6	.3750		6	.5250
	7	.0791		7	.2291		7	.3791		7	.5291
	8	.0833		8	.2333		8	.3833		8	.5333
	9	.0875		9	.2375		9	.3875		9	.5375
	10	.0916		10	.2416		10	.3916		10	.5416
	11	.0958		11	.2458		11	.3958		11	.5458
2	0	.1000	5	0	.2500	8	0	.4000	11	0	.5500
	1	.1041		1	.2541		1	.4041		1	.5541
	2	.1083		2	.2583		2	.4083		2	.5583
	3	.1125		3	.2625		3	.4125		3	.5625
	4	.1166		4	.2666		4	.4166		4	.5666
	5	.1208		5	.2708		5	.4208		5	.5708
	6	.1250		6	.2750		6	.4250		6	.5750
	7	.1291		7	.2791		7	.4291		7	.5791
	8	.1333		8	.2833		8	.4333		8	.5833
	9	.1375		9	.2875		9	4375		9	.5875
	10	.1416		10	.2916		10	.4416		10	.5916
	11	.1458		11	.2958		11	.4458		11	.5958

Table XIII.

The Decimal Parts of One Pound—*continued.*

s.	*d.*	Decim.	*s.*	*d.*	Decim.	*s.*	*d.*	Decim.	*s.*	*d.*	Decim.
12	0	.6000	14	0	.7000	16	0	.8000	18	0	.9000
	1	.6041		1	.7041		1	.8041		1	.9041
	2	.6083		2	.7083		2	.8083		2	.9083
	3	.6125		3	.7125		3	.8125		3	.9125
	4	.6166		4	.7166		4	.8166		4	.9166
	5	.6208		5	.7208		5	.8208		5	.9208
	6	.6250		6	.7250		6	.8250		6	.9250
	7	.6291		7	.7291		7	.8291		7	.9291
	8	.6333		8	.7333		8	.8333		8	.9333
	9	.6375		9	.7375		9	.8375		9	.9375
	10	.6416		10	.7416		10	.8416		10	.9416
	11	.6458		11	.7458		11	.8458		11	.9458
13	0	.6500	15	0	.7500	17	0	.8500	19	0	.9500
	1	.6541		1	.7541		1	.8541		1	.9541
	2	.6583		2	.7583		2	.8583		2	.9583
	3	.6625		3	.7625		3	.8625		3	.9625
	4	.6666		4	.7666		4	.8666		4	.9666
	5	.6708		5	.7708		5	.8708		5	.9708
	6	.6750		6	.7750		6	.8750		6	.9750
	7	.6791		7	.7791		7	.8791		7	.9791
	8	.6833		8	.7833		8	.8833		8	.9833
	9	.6875		9	.7875		9	.8375		9	.9875
	10	.6916		10	.7916		10	.8916		10	.9916
	11	.6958		11	.7958		11	.8958		11	.9958

Dilapidations.

As it is the duty of an Architectural Surveyor to estimate the dilapidations to buildings and their appurtenances, we propose to give an outline of the practice laid down in a report on the subject by a Committee of the Royal Institute of British Architects in 1843:—

In the first place a dilapidation may be defined in the words of the report as extending "To those defects only which have arisen from neglect or misuse, and *not* to such as only indicate age, so long as the efficiency of the part still remains; but if the effects of use or age have proceeded so far as to destroy the part or its efficiency in the structure, this argues neglect or misuse; it being the presumption that at the commencement of his term, the tenant was satisfied that every part was sufficiently strong to last to its close."

The following is a list of what usually comes under the head of dilapidations when not otherwise stated in the lease or other document under which the claim arises.

Bricklayer's Work.

Defective brickwork in walls, chimney shafts, parapets, &c.

Walls out of the perpendicular, cracked, split, or bulged, so as to be unsafe or incapable of being effectually repaired.

Decayed mortar joints.

Broken or loose chimney pots.

Broken or defective pavings.

Broken loose or defective tiles.

Drains or cesspools stopped or out of repair.

Accumulations of soil and rubbish.

Mason's Work.

All stonework in the building when loose, damaged, or defective, also curbs or copings to areas or railings.

Water channels.
Sinks.
Shelves.
Pavings.

And other works, both external and internal when loose, damaged, or defective, also chimney pieces, slabs, and inner hearths when broken or out of level.

Note.—Broken or damaged portions of steps, landings, cornices, lintels, sills, string courses, plinths, and other stone dressings may be repaired by filling in pieces where it can be done in a sound and efficient manner.

Slater's and Slate Mason's Work.

Loose, broken, or defective slates.
Broken or loose shelves, slabs, or pavings.

Carpenter's and Joiner's Work.

Loose, broken, or defective timbers to roofs or otherwise.
Rafters, floor joists, or other timbers out of level.

Wood fences, external doors, frames, gates and posts, when loose, broken, decayed, or defective.

Note.—When the bottom of posts only are decayed, the tenant may be allowed to put spurs thereto instead of new posts.

Floors broken, loose, or rotten, or if out of level when occasioned by neglect.

Doors and shutters, with loose, broken, or defective hinges and fastenings.

Sashes and frames injured or decayed, or with broken sash lines or defective fastenings.

Treads of stairs and other joiner's work in any way injured or defective through neglect or misuse.

Smith's and Ironmonger's Work.

Loose, broken, or damaged iron-work of every description throughout the premises; imperfect hanging and fastenings to iron gates, &c., are all to be considered as dilapidations.

Plasterer's Work.

All unsound, loose, damaged, or defective plastering.

Nail holes.

Mouldings or enrichments when broken or defaced.

Whitening and colouring of walls when soiled or damaged through neglect or misuse.

Plumber's Work.

Damaged, loose, or defective portions of lead-work in flats, gutters, hips, ridges, valleys, flashings, cistern heads and pipes.

Pumps, water-closets, soil pipe, &c., when damaged or out of repair.

Painter's Work.

External painting on wood and iron when neglected so as to effect their preservation.

Paint on stone-work, or stucco, &c., when defaced.

Note.—Inside painting, except when damaged or defective, is not supposed to be renewed, unless so expressed in the lease or agreement.

Glazier's Work.

Broken glass and defective putty are dilapidations; also defective lead-work to lights, &c.

Note.—Glass with only one crack, except when in superior rooms, is not usually required to be renewed.

Paper-Hanger's Work.

Papering loose, torn or soiled, as by hanging pictures, laying furniture against the wall or otherwise.

Yearly tenants are only liable for such damage, waste, or repairs, as are necessary to maintain the building wind and water-tight.

Ecclesiastical Dilapidations.

The damages or dilapidations to a vicarage or parsonage house, charged to the representatives of a late Incumbent, are similar to what has been already stated in civil cases. An important legal decision has relieved the Incumbent from supplying or maintaining anything in the nature of ornament, such as white-washing and papering, or painting, unless to preserve exposed timbers from decay.

The representatives of the Incumbent are liable for the expense of restoring such parts of the building to its original character, allowing for fair wear and tear, as may have been repaired or reinstated in an insufficient or improper manner.

The Incumbent is also bound to keep the chancel of his church in repair.

Fixtures.

" Whatever is fixed to the soil or out-house, or farm yard wall, so as to become a part thereof, cannot be removed, and will, at the expiration of the lease, belong to the lessor; but a tenant may remove what he has placed for the convenience of his *trade*, as engines, counters, brewing vessels, &c., provided he does it during the continuance of his term, and has not expressly covenanted to the contrary. Erections for the purpose of farming and agriculture do not come under the exceptions with respect to *trade*, and cannot be taken down again.

Wainscot, doors, floors, and other things fixed with *nails* cannot be removed; but chimney pieces, pier-glasses, cupboards fixed with holdfasts, book-cases, and wainscot put up with *screws* may be removed, so that the removal does not cause serious damage to the premises.

All fixtures put up by the tenant must be removed *during his term;* otherwise, at the expiration of the term they become the landlord's property."—*Cabinet Lawyer*.

THE FOLLOWING HAVE BEEN DECIDED BY THE COURTS TO BE REMOVABLE.

(CHITTY.)

Barns and other buildings set on the blocks.
Bells.
Bins.
Blinds.
Book-cases.
Cabinets.
Chimney pieces (ornamental).
Chimney-glasses.
Cisterns.
Clock cases.
Coffee mills.
Coppers.
Cornices (ornamental).
Cupboards.
Furnaces.
Grates.
Hangings.
Iron backs to chimneys.
Iron ovens.
Jacks.
Lamps.
Looking-glasses.
Ornametal fixtures.
Ovens.
Pier-glasses.
Presses.
Pumps, slightly attached.
Rails.
Ranges.
Sheds.
Shelves.
Sinks.
Stoves.
Tapestry
Turret clocks.
Wainscot, fixed by screws.

TRADE FIXTURES HELD TO BE REMOVABLE.

Brewing vessels and pipes.
Cider mills.
Cisterns.
Closets.
Colliery machines.
Coppers.
Counters.
Cranes.
Desks.
Drawers.
Engines.
Fire-engines.
Furnaces.
Gas pipes.
Glass fronts.
Iron safes.
Partitions.
Presses.
Pumps.
Reservoirs.
Salt pans.
Shelves.
Shrubs and trees planted for sale.
Soap works.
Steam-engines.
Stills.
Sun blinds.
Vats.

Articles held not to be Removable.

Box borders.
Carpenter's shop, smithy, &c.
Chimney-pieces (not ornamental).
Coach or cart houses.
Conservatories.
Doors.
Dressers.
Flowers.
Fruit and other trees (except by nursery-men).
Glass windows.
Hearths.
Hedges.
Keys.
Locks.
Mill stones.
Partitions (except trade).
Pigeon-house.
Racks in stables.
Strawberry-beds.
Waggon sheds.

SCALE OF PROFESSIONAL CHARGES FOR ARCHITECTS AND SURVEYORS.

Architect's rates.—

1. Preliminary sketches and designs complete, including survey of site, &c.	$1\frac{1}{4}$ per Cent.
2. General drawings, plans, elevations and sections, specification and approximate estimate	$1\frac{1}{4}$,,
3. Working and detail drawings . . .	$1\frac{1}{4}$,,
4. Personal supervision and superintendence—exclusive of clerk of works .	$1\frac{1}{4}$,,
Total charge per Cent.	5

Note.—The above charge of 5 per Cent. is to be estimated on the value of the work executed, including such materials and labour as may be supplied by the owner; omitted work is to be paid for under items 1, 2, and 3, according to the stage of the proceedings at which the alteration was determined upon.

Procuring and examining tenders for the work . . . . $\frac{1}{2}$ per Cent. in addition to the foregoing.

Arranging with artists, tradesmen, and others, for sculpture, stained glass, and works of a similar class for which the architect does not furnish the design; but to which he gives a general supervision	$2\frac{1}{2}$ per Cent. on the value.
Alterations in the design—extra labour in attending committee meetings—arranging disputes with adjoining owners, &c.	at per day.
Travelling and incidental expenses .	extra.
Measuring up works and certifying the builder's accounts for extras and omissions	as per surveyor's rates.

An architect is bound under the 5 per Cent. charge to provide one set of drawings and one set of tracings, with duplicate specification; it being understood that the architect is paid for the use only of the drawings and specification, and that they remain his property at the completion of the work.

Payment on account, at the rate of 5 per Cent. to be made on the instalments paid to the builder, or otherwise to half the commission on the signing of the contract, and the remainder by instalments as above.

Surveyor's rates.—

The charge for measuring works in small new buildings, and in repairs, including a bill of the particulars is . . .	$2\frac{1}{2}$ per Cent.
For large new works of plain character the usual charge is	$1\frac{1}{2}$,,

When the works are of elaborate construction the charge will vary from $1\frac{1}{2}$ per Cent. upwards, according to the additional trouble entailed in measuring.

For works of very small value the charge is by the day.

Estimating quantities from plans and specifications, and preparing the "bills of quantities"—for very small or difficult works the charge is . . .	$2\frac{1}{2}$ per Cent.
Ditto, for ordinary works of £10,000 value or under	$1\frac{1}{2}$,,
Ditto, above £10,000, the first £10,000 being charged under the last item .	1 ,,

Lithographing and travelling expenses are charged extra.

In important works where the quantities are taken out conjointly by two different surveyors half of the above rates are due to each surveyor. In large works of very plain character, especially when many simple repetitions occur, lower rates than the foregoing are sometimes considered sufficient.

Scale of Charges for Valuations as adopted by an eminent London Firm.

On the first £100 . .	5 guineas per cent.
,, second . . .	$2\frac{1}{2}$,,
,, third to tenth .	1 ,,
Above £1000	$\frac{1}{2}$,, The first thousand being charged at the rate of $1\frac{1}{2}$ guineas per cent.

Minimum rate charged by architects and surveyors when paid by the day = 3 guineas.

Improved Scale of Charges for Valuations.

Amount of Valuation.	Rate.	Charge. £	s.	d.
Not exceeding £100	5 per cent.	5	0	0
,, 200	,, on £100 and 2 per cent. up to £200	7	0	0
,, 300	,, ,, ,, 300	9	0	0
,, 400	,, ,, ,, 400	11	0	0
,, 500	,, ,, ,, 500	13	0	0
,, 600	,, on £200 and 1 per cent. up to £600	14	0	0
,, 700	,, ,, ,, 700	15	0	0
,, 800	,, ,, ,, 800	16	0	0
,, 900	,, ,, ,, 900	17	0	0
,, 1000	,, ,, ,, 1000	18	0	0
,, 1100	,, ,, ,, 1100	19	0	0
,, 1200	,, ,, ,, 1200	20	0	0
,, 1300	,, ,, ,, 1300	21	0	0
,, 1400	,, ,, ,, 1400	22	0	0
,, 1500	,, ,, ,, 1500	23	0	0
£2000 and over £1500	1¼ per cent.	25	0	0
2500 ,, 2000	,, on £2000 and ½ per cent. after	27	10	0
3000 ,, 2500	,, ,, ,, ...	33	0	0
4000 ,, 3000	1 per cent. on £3000 ,, ...	35	0	0
5000 ,, 4000	,, ,, ,, ...	40	0	0
Above 5000	,, ,, ,, ...	—		

APPENDIX.

WEIGHTS AND MEASURES.

Square Measure.

inches						
144 =	1 foot					
1296 =	9 =	1 yard				
39204 =	272.25 =	30.25 =	1 perch			
1568160 =	10890 =	1210 =	40 =	1 rood		
6272640 =	43560 =	4840 =	160 =	4 =	1 acre	

Square Measure (Land).

links			
625 =	1 perch		
10000 =	1 chain		
25000 =	2.5 =	1 rood	
100000 =	10 =	4 =	1 acre

Solid Measure.

cubic inches		
1728 =	1 cubic foot	
46656 =	27 =	1 cubic yard

Liquid Measure.

cubic inches								
34.66 =	1 pint							
69.318 =	2 =	1 quart						
277.274 =	8 =	4 =	1 gallon					
11645.508 =	336 =	168 =	42 =	1 tierce				
17467.262 =	504 =	252 =	63 =	$1\frac{1}{2}$ =	1 hogshead			
23291.016 =	672 =	336 =	84 =	2 =	$1\frac{1}{3}$ =	1 puncheon		
34936.524 =	1008 =	504 =	126 =	3 =	2 =	$1\frac{1}{2}$ =	1 pipe	
69873.048 =	2016 =	1008 =	252 =	6 =	4 =	3 =	2 =	1 tun

Note.—The imperial gallon contains 10 lbs. distilled water at 62° Fahrenheit, and a cubic foot contains 6.232106 imperial gallons.

Dry Measure.

gallons
2 = 1 peck
8 = 4 = 1 bushel = 1.284 cubic feet
64 = 32 = 8 = 1 quarter
320 = 160 = 40 = 5 = 1 load or wey
640 = 320 = 80 = 10 = 2 = 1 last

Troy Weight.

grains
24 = 1 pennyweight
480 = 20 = 1 ounce
5760 = 240 = 12 = 1 pound = 22.816 cubic inches of distilled water at 62° Fahr.

Apothecaries' Weight.

grains
20 = 1 scruple
60 = 3 = 1 drachm
480 = 24 = 8 = 1 ounce
5760 = 288 = 96 = 12 = 1 pondd

Avoirdupois Weight.

drachms
16 = 1 ounce = 437.5 grains troy
256 = 16 = 1 pound = 1.2153 lbs. troy
7168 = 448 = 28 = 1 quarter
28672 = 1792 = 112 = 4 = 1 cwt.
573440 = 35840 = 2240 = 80 = 20 = 1 ton

Long Measure.

inches
12 = 1 foot
36 = 3 = 1 yard
72 = 6 = 2 = 1 fathom
198 = 16.5 = 5.5 = 2.75 = 1 perch or pole
7920 = 660 = 220 = 110 = 40 = 1 furlong
63360 = 5280 = 1760 = 880 = 320 = 8 = 1 mile

Land Measure.

inches			
7.92 =	1 link		
792 =	100 =	1 chain	
63360 =	8000 =	80 =	1 mile

Nautical Measure.

Nautical mile

1 = 6082.66 feet
3 = 1 league
60 = 20 = 1 degree = 69.121 English miles

Scotch and Irish Measure.

English mile	= 1760	yards	= 1.00000
Scotch ,,	= 1984	,,	= 1.12159
Irish ,,	= 2240	,,	= 1.27273
English acre	= 4840	sq. yds.	= 1.00000
Scotch ,,	= 6150.4	,,	= 1.27074
Irish ,,	= 7840	,,	= 1.61983

Miscellaneous Articles.

A cable's length............	= 60 yards
A geometrical degree ...	= 69.121 English miles
The old wine gallon	= 231 cubic inches
,, ale gallon	= 281 ,,
A stone	= 14 lbs.
20 articles.....................	= 1 score
12 dozen.......................	= 1 gross
A cord of wood	= 128 cubic feet
A faggot of steel...........	= 120 lbs.
A cask of blacklead	= 11½ cwt.
Pig of ballast	= 56 lbs.
Truss of straw...............	= 56 lbs.
Truss of hay..................	= 56 lbs.
A load of hay or straw...	= 36 trusses

French Lineal Measure.

Millimètre =	0.0393708	English	inches
Centimètre =	0.3937079	,,	,,
Decimètre =	3.937079	,,	,,
Mètre	39.37079	,,	,,
	3.2808992	,,	feet
	1.093633	,,	yards
Kilomètre =	1093.633	,,	,,
Myriamètre =	6.2131	,,	miles

French Superficial Measure.

	Mètre	Eng. sq. ft.	Eng. perches
Centiare =	1 =	10 7643	=0.039538
Deciare...=	10 =	107.643	=0.39538
Are.........=	100 =	1076.43	=0.0988457 roods
Hectare =	10000 =	107643.	=2.471143 acres

French Solid Measure.

Stere ......=	1 Mètre =	35.316575	Eng.	cubic feet
Decastere =	10 ,, =	353.165753	,,	,,
Hectastere =	100 ,, =	3531.657535	,,	,,
Kilostere =	1000 ,, =	35316.575358	,,	,,
Myriastere =	10000 ,, =	353165.753581	,,	,,

French Weights.

Gramme......=15.43235 grains
Kilogramme= 2.20462 lbs. avoirdupois
Tonne......... = 1.01605 tons

INDEX.

THE END.

C. WHITING, PRINTER.